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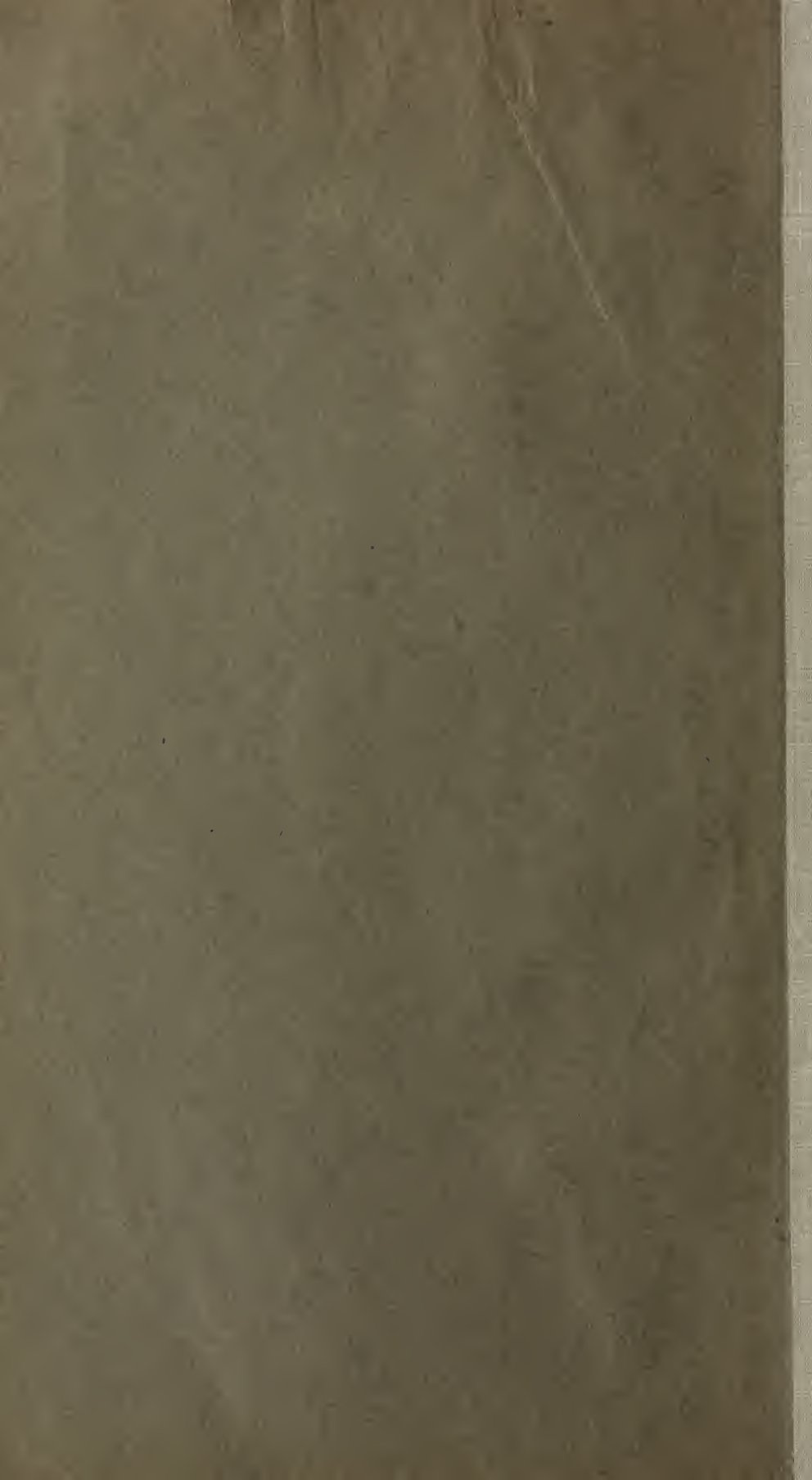
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THE MUSEUM OF THE AMERICAN INDIAN
HEYER FOUNDATION
Volume III

PHYSICAL ANTHROPOLOGY OF THE
LENAPE OR DELAWARES, AND OF
THE EASTERN INDIANS
IN GENERAL

BY
ALEŠ HRDLÍČKA

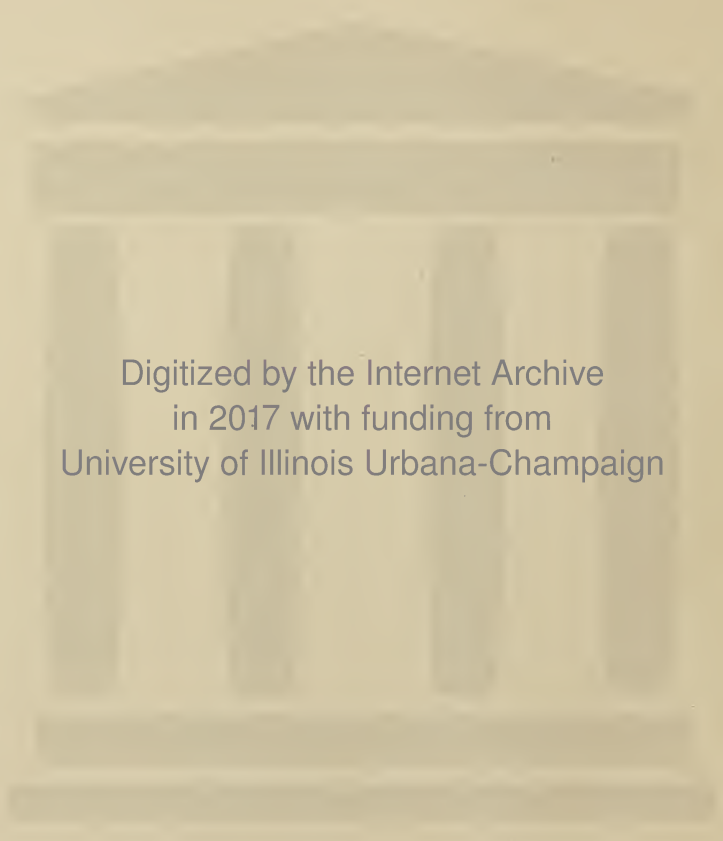
NEW YORK
THE MUSEUM OF THE AMERICAN INDIAN
HEYER FOUNDATION
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NOTE

This memoir, published in the series of Bulletins of the Bureau of American Ethnology, is based largely on a collection of skeletal remains recovered by an expedition of the Museum of the American Indian in the summer of 1914 in a cemetery associated with the site of an historic Munsee settlement near Montague, in the Delaware valley, northwestern New Jersey. These skeletal remains were presented to the United States National Museum by the Museum of the American Indian and therefore formed the basis of the study by Dr Hrdlička, the results of which are herein presented. The archeological observations conducted at the Munsee site are incorporated in a paper bearing the title "Exploration of a Munsee Cemetery near Montague, New Jersey," by George G. Heye and George H. Pepper, which forms Volume II, No. 1, of *Contributions from the Museum of the American Indian*, to which the present memoir may be regarded as supplementary.



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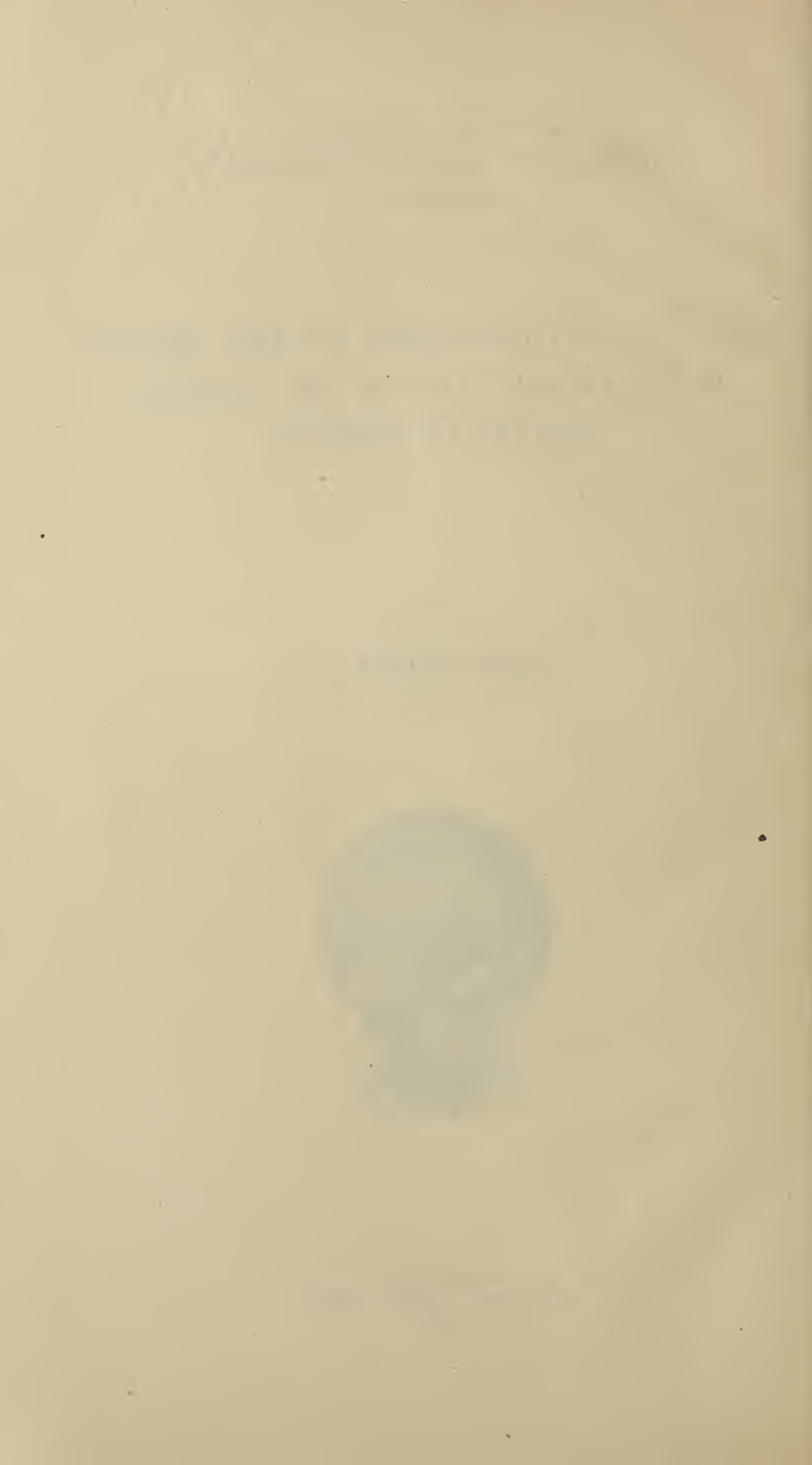
PHYSICAL ANTHROPOLOGY OF THE LENAPE
OR DELAWARES, AND OF THE EASTERN
INDIANS IN GENERAL

BY

ALEŠ HRDLIČKA



WASHINGTON
GOVERNMENT PRINTING OFFICE
1916



LETTER OF TRANSMITTAL

WASHINGTON, D. C., *November 10, 1915.*

SIR: I have the honor to transmit herewith a report by Dr. Aleš Hrdlička on "Physical Anthropology of the Lenape or Delawares, and of the Eastern Indians in General," and to recommend its publication as a bulletin of the Bureau of American Ethnology.

Very respectfully,

F. W. HODGE,
Ethnologist-in-Charge.

HON. CHARLES D. WALCOTT,
Secretary, Smithsonian Institution.

CONTENTS

I. SKELETAL REMAINS OF THE MUNSEE

	Page
Introduction.....	11
Condition of the collection.....	15
General.....	15
Age and sex.....	15
Artificial deformation.....	16
Pathology.....	16
The crania.....	19
General observations: Differences in type.....	19
Chief descriptive features.....	20
Measurements.....	20
Form of the vault.....	20
Size of the skull.....	22
Relation of size of skull to stature.....	23
Size and shape of the face.....	25
Orbits. Nose.....	27
Prognathism.....	28
Palate.....	30
Foramen magnum.....	31
Lower jaw.....	32
Detailed observations on the crania.....	32
The vault: Forehead.....	32
Sagittal region.....	33
Temporo-parietal region.....	33
Occiput.....	34
Sutures: Serration.....	34
Occlusion of sutures.....	35
Wormian bones.....	35
Bregma and Inca bones.....	36
Parietal foramina.....	36
Retromastoid foramina.....	37
Mastoids.....	37
Supraorbital ridges.....	38
Nasion depression.....	39
Nasal bridge.....	39
Nasal bones.....	40
Nasal aperture.....	40
Nasal spine.....	40
Orbits.....	41
Suborbital fossæ.....	41
Malar bones. Zygomæ.....	42
Upper alveolar arch.....	42
Lower jaw.....	43
Palate.....	43

The crania—Continued.

Detailed observations on the crania—Continued.

	Page
Base of the skull.....	43
Glenoid fossæ.....	43
Floor of the auditory meatus.....	44
Styloid processes.....	44
Middle lacerated foramina. Posterior lacerated foramina.....	45
Depressions of the petrous portions.....	46
Pterygo-basal foramina.....	46
Posterior condylic foramina.....	47
Miscellaneous anomalies.....	47
The teeth.....	48
Dentition.....	48
Loss and decay.....	48
Wear.....	48
Size, quality, shovel-shaped incisors.....	48
Anomalies.....	49
Cuspids.....	49
Summary of measurements and observations on the crania.....	50
The bones.....	52
Humerus.....	52
General observations.....	52
Detailed observations.....	55
Shape of the shaft.....	55
Perforation of the septum.....	55
Supracondyloid process.....	56
Radius.....	56
Ulna.....	57
Femur.....	58
General observations.....	58
Measurements.....	58
Humero-femoral index.....	61
The shaft.....	61
Platymery.....	63
Special characteristics of the femora.....	65
Linea aspera.....	66
Shape of the shaft.....	66
Third trochanter.....	66
Tibia.....	67
Fibula.....	70
Clavicle.....	71
Sternum.....	72
Scapula.....	73
General features.....	73
Descriptive features.....	75
Type of body.....	75
Superior border.....	76
Scapular notch.....	78
Ribs.....	79
Spine.....	80
Sacrum.....	81
General observations and measurements.....	81
Segments.....	82
Curvature.....	82

The bones—Continued.	Page
Ossa innominata and pelvis.....	83
The ossa innominata.....	83
The pelvis as a whole.....	85
Short and other bones.....	87
Patella.....	87
Bones of the hand.....	90
Bones of the feet.....	91
First metatarsal.....	91
Os calcis.....	93
Articular facets for astragalus.....	95
Astragalus.....	96
Scaphoid.....	99
Cuboid.....	102
Internal cuneiform.....	104
External and middle cuneiform.....	106
Summary of measurements and observations on parts of the Munsee skeleton other than the skull.....	106

II. EASTERN INDIAN CRANIA IN GENERAL

General observations.....	110
Cranial index.....	114
Height of skull.....	116
Size of skull.....	117
Facial measurements.....	119
Height of the face.....	119
Breadth of the face.....	119
Orbits.....	120
Nasal index.....	121
Palate.....	122
Prognathism.....	122

APPENDIX

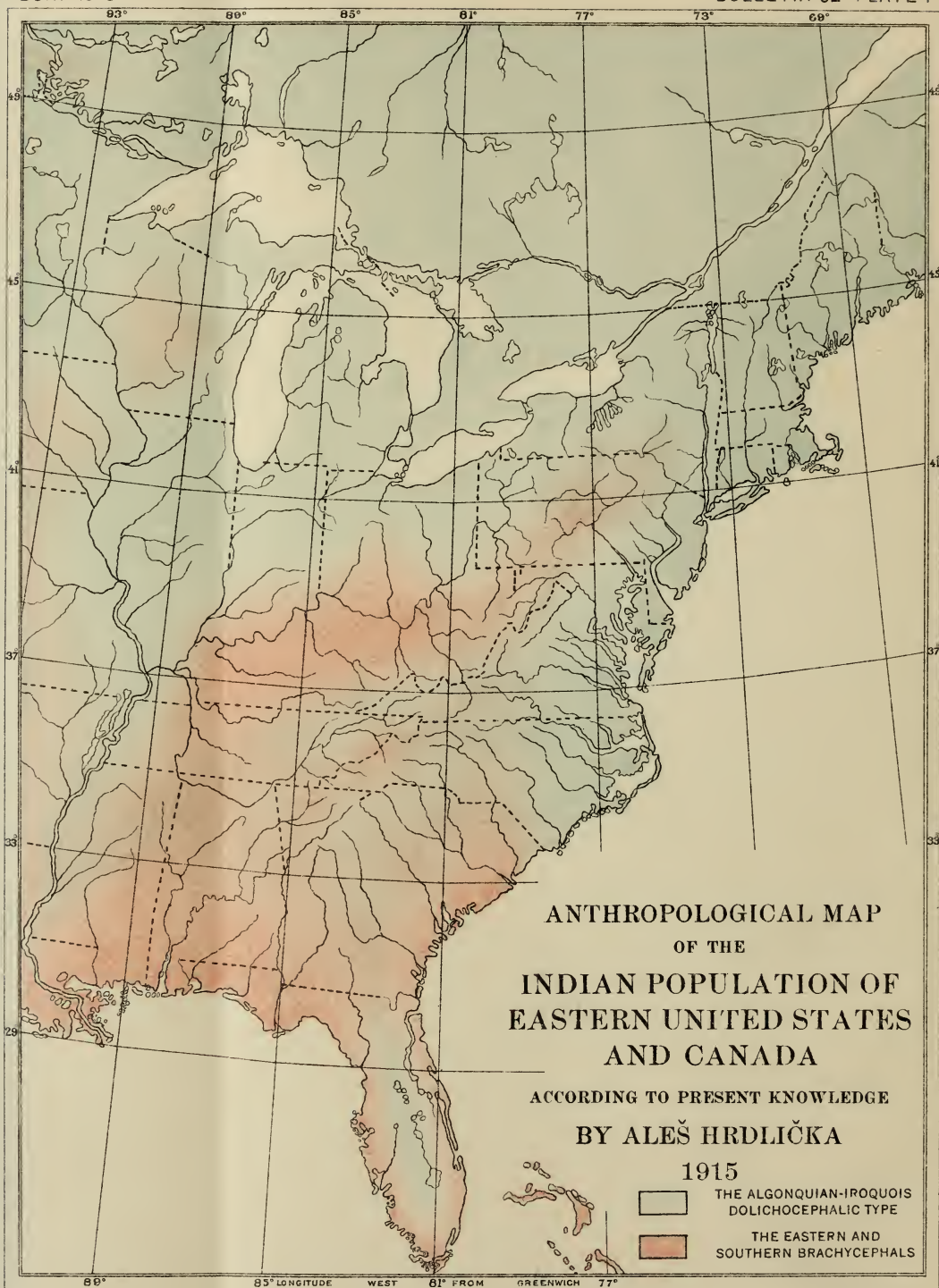
Iroquois and most nearly related Eastern Indian crania.....	127
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ILLUSTRATIONS

PLATE		Page
1.	Anthropological map of the Indian population of eastern United States and Canada according to present knowledge.....	11
2.	General view of the locality of the Munsee cemetery at Minisink, New Jersey.....	15
3.	Plan of the Munsee burial site showing location and position of the burials.....	17
4.	Two typical Munsee burials in moderately contracted position.....	18
5.	Two burials in extended position.....	20
6.	Male Munsee skull No. 285,303, U.S.N.M. (front view).....	22
7.	Male Munsee skull No. 285,303, U.S.N.M. (side view).....	25
8.	Male Munsee skull No. 285,303, U.S.N.M. (view from above), showing typical features.....	26
9.	Male skull No. 99-6669, A. M. N. H., from Manhattan Island (front view).....	28
10.	Male skull No. 99-6669, A. M. N. H., from Manhattan Island (side view).....	31
11.	Male skull No. 99-6669, A. M. N. H., from Manhattan Island (view from above), showing long ovoid outline.....	32
12.	Male Munsee skull No. 285,308, U.S.N.M. (front view).....	34
13.	Male Munsee skull No. 285,308, U.S.N.M. (side view).....	37
14.	Male Munsee skull No. 285,308, U.S.N.M. (view from above).....	38
15.	Undeformed typical female Munsee skull No. 285,309, U.S.N.M. (view from above).....	40
16.	Male Munsee skull No. 285,306, U.S.N.M., showing fine ovoid outline.....	40
17.	Large male skull No. 2010-4423, A. M. N. H., from Manhattan Island, showing fine elliptical outline.....	40
18.	Adult male skull from Manhattan Island, No. 99-6667, A. M. N. H., showing an exceptionally high and narrow face.....	42
19.	Brachycephalic extraneous female skull, No. 285,311, U.S.N.M. (view from above), found with the Munsee Indians.....	44
20.	Skull of Munsee child of about six years of age, No. 285,329, U.S.N.M., showing fronto-occipital compression.....	45
21.	Base of female skull No. 285,311, U.S.N.M. (brachycephalic extraneous), found among the Munsee burials, showing excessive size of the foramina ovale, especially on the right side.....	48
22.	Lower jaw of female Munsee skull No. 285,307, U.S.N.M., showing complete fusion of the right lower lateral incisor and canine.....	49
23.	Supracondyloid process in a femur, and a spurious supracondyloid foramen in a humerus of the Munsee.....	54
24.	Fusion of humerus and ulna; male Munsee skeleton No. 285,303, U.S.N.M.....	58

	Page
PLATE 25. <i>a.</i> The seventh cervical vertebra of female Munsee skeleton No. 285,311, U.S.N.M., with a cervical rib.	
<i>b.</i> Scapula of female Munsee skeleton No. 285,328, U.S.N.M., showing semilunar shape of the superior border.....	76
26. <i>a.</i> Male Munsee sacrum showing bilateral articulation with an extra segment introduced between the last lumbar and the sacrum.	
<i>b.</i> Female Munsee sacrum showing bilateral articulation with extra segment.....	81
27. Female Munsee sacrum showing unilateral articulation with the fifth lumbar.....	82
28. <i>a.</i> Patella of female Munsee skeleton No. 285,311, U.S.N.M., showing marked obliquity.	
<i>b.</i> Patellæ of female Munsee skeleton No. 285,309, U.S.N.M., showing pronounced vastus notch.	
<i>c.</i> Internal cuneiforms of male Munsee skeleton No. 285,301, U.S.N.M., showing each a double metatarsal facet.	
<i>d.</i> Pair of female Munsee scaphoids showing unusual broad talus facet and peculiar tuberosity.....	90
29. <i>a.</i> The right and left first metatarsal of Munsee skeleton No. 285,326, U.S.N.M., showing disproportion in size; also a canal in the smaller bone, possibly the vestige of an early fracture.	
<i>b.</i> The calcanei of male Munsee skeleton No. 285,313, U.S.N.M., showing wide separation of the two facets for the astragalus.....	96
FIGURE 1. Map showing the location of the Munsee cemetery.....	12

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PHYSICAL ANTHROPOLOGY OF THE LENAPE OR DELAWARES, AND OF THE EAST- ERN INDIANS IN GENERAL

I. SKELETAL REMAINS OF THE MUNSEE

INTRODUCTION

IN 1902, in pursuance of a study of the antiquity of certain skeletal remains found in the vicinity of Trenton, New Jersey, the writer collected and described all the crania of the Lenape or Delaware Indians which at that time were preserved in our museums.¹ From that time until 1914 no further anthropological discoveries of consequence were made in the region over which the tribe once extended; but during the spring of the latter year careful archeological exploration was conducted in the upper Delaware River valley in behalf of the Museum of the American Indian in New York, by Mr. George G. Heye, with the assistance of Mr. George H. Pepper, in the course of which were found the remains of no fewer than 57 Indian skeletons.² The bones were not in the best state of preservation, but they were collected with scrupulous care, and shortly after the field work was completed they were presented by Mr. Heye to the United States National Museum. This skeletal material forms an important addition to the previously limited collections representing the Lenape Indians, whose physical identity it is highly desirable to establish.

The remains came from a cemetery in the form of a low mound on the New Jersey side of the Delaware River, opposite Minisink Island, 3 miles below Montague, in the northwestern corner of Sussex County, New Jersey. The accompanying map (fig. 1) shows the site of the cemetery, which lay in the heart of the region once occupied by the Munsee branch of the Lenape Indians.

¹ Hrdlička, *The Crania of Trenton, New Jersey, and their Bearing upon the Antiquity of Man in that Region*, *Bull. Amer. Museum of Natural History*, xvi, art. 311, New York, 1902, pp. 23-62, 22 pl., 4 fig.

² For details and archeological results, see George G. Heye and George H. Pepper, *Exploration of a Munsee Cemetery near Montague, New Jersey*, *Contributions from the Museum of the American Indian (Heye Foundation)*, II, pt. 1, New York, 1915. The Heye Expedition reports some additional burials, but the skeletal remains therefrom were in a very defective condition.

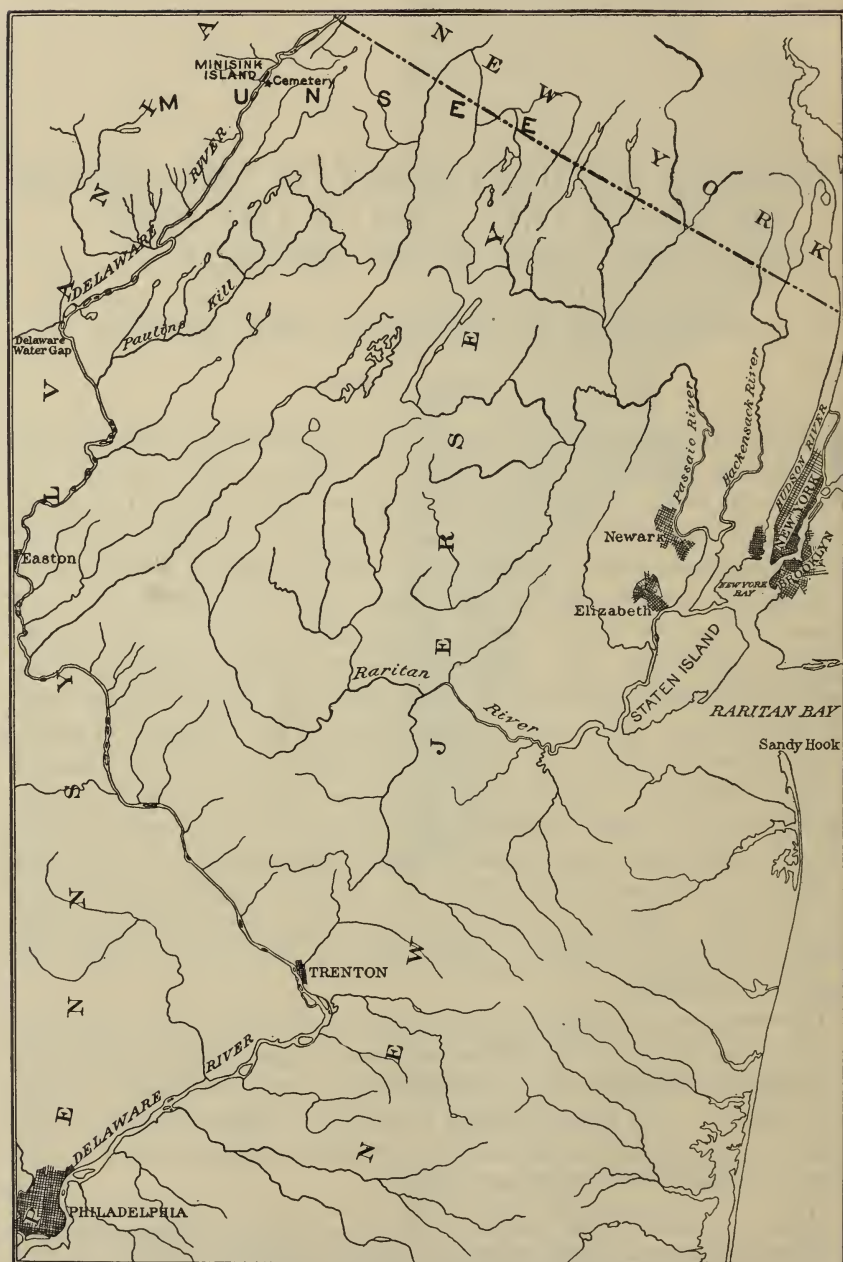


FIG. 1.—Map showing the location of the Munsee cemetery.

On the arrival of white settlers, the entire region afterward known as New Jersey belonged to the Lenape or Delawares,¹ whose settlements extended "from the Mohicannituck [Hudson River] to beyond the Potomac," and "from the heads of the great rivers 'Susquehannah' and 'Delaware' to the Atlantic Ocean" (Heckewelder). The neighboring tribes to the north (Mohegan, Narraganset, Pequot, and others), as well as those on the south (Nanticoke, the Powhatan confederacy, and others), all acknowledged relationship with the Delawares, with whom, there is no doubt, they were affiliated linguistically.

The Lenape were divided into three large groups, or, as Brinton calls them, "sub-tribes," namely, the Munsee or Minsi (the Wolf), the Unami (the Turtle), and the Unalachtigo (the Turkey).² These subtribes, it seems, were subdivided into numerous smaller groups with distinctive names.³ The three branches of the tribe occupied special regions, but it has not been reported whether their boundaries were stable and definite. The Minsi, according to Heckewelder,⁴

¹ Captain John Smith's Works, 1608-1631, Arber ed., Birmingham, 1884; William Penn's Letters, 1683; G. Thomas, *History of New Jersey*, London, 1698; Thomas Campanius Holm, *Short Description of New Sweden*, Stockholm, 1702, transl. by Duponceau in *Memoirs of the Historical Society of Pennsylvania*, III, Phila., 1834; T. Acrelius, *History of New Sweden*, Stockholm, 1759, transl. in *Memoirs of the Historical Society of Pennsylvania*, XI, 1874; Samuel Smith, *History of the Colony of Nova Cesarea or New Jersey*, Burlington, 1765; Peter Kalm, *Travels into North America*, London, 1770-71; G. H. Loskiel, *History of the Mission of the United Brethren among the Indians in North America*, London, 1794; Geo. Chalmers, *Political Annals of the Present United Colonies*, etc., 1780, *New York Historical Society Collections*, 1868; John G. E. Heckewelder, *History, Manners and Customs of the Indian Nations who once Inhabited Pennsylvania and the Neighboring States*, Phila., 1819, *Mem. Hist. Soc. Penn.*, XII, 1876; also MSS.; James Grahame, *History of the Rise and Progress of the United States of North America*, London, 1827 (new ed., 1836, 1845); Thos. F. Gordon, *History of New Jersey*, Trenton, 1834; J. Curt's Clay, *Annals of the Swedes on the Delaware*, Phila., 1835; Yates and Moulton, *New York*, N. Y., 1824; Isaac Mickle, *Reminiscences of Old Gloucester*, Phila., 1845, Camden, 1877; A. Gifford, *Aborigines of New Jersey*, *Proc. N. J. Hist. Soc.*, IV, Newark, 1859, pp. 163-198; D. G. Brinton, *The Lenape and their Legends*, Phila., 1885; *Handbook of American Indians*, Bull. 30, Bureau of American Ethnology, Washington, 1907-1910.

² These designations are not translations of the terms given in parentheses, but "refer to the location of these sub-tribes on the Delaware River," Minsi (from *minthin*, to be scattered, and *achsin*, stone), meaning "people of the stony country" or "mountaineers"; Unami (from *nahen*, down-stream) means "people down the river"; and Unalachtigo (from *wunlawat*, to go towards, and *t'kow* or *t'kou*, wave) means "people who live near the ocean." Wolf, Turtle, and Turkey are the totemic designations of the three sub-tribes. (Brinton, op. cit., p. 34.)

³ From the above tribes, in course of time, sprang many others "who, having for their own convenience, chosen distant spots to settle on, and increasing in numbers, gave themselves names or received them from others." (Heckewelder, *Hist. Indian Nations*, p. 53; see also *ibid.*, p. 51.)

⁴ Heckewelder, *Hist. Ind. Nations*, p. 52. Brinton (op. cit., p. 37) is of the opinion, but on what grounds is not stated, that the extent of the territory of the Munsee as given here is too great. In his words, "that at any time, as Heckewelder asserts, their [the Munsee] territory extended up to the Hudson as far as tide-water, and westward 'far beyond the Susquehannah' is surely incorrect. Only after the beginning of the eighteenth century, when they had been long subject to the Iroquois, have we any historic evidence that they had a settlement on the last named river." It seems, however, that even if the presence of the Munsee on or beyond the Susquehannah may be open to contention, their presence along the Hudson is well established. Gifford (*Aborigines of New Jersey*, p. 180) states that "the Minsi tribe extended as far on the west banks of the Hudson as Tappan." Yates and Moulton (*History of New York*, I, p. 225) place the Minsi even farther east, "from Long Island to and beyond Minisink." According to Rutenber (*History of the Indian Tribes of Hudson's River*, p. 50) the Munsee territory "extended from the Katskill mountains to the headwaters of the Delaware and Susquehanna rivers, and was bounded on the east by the Hudson; their council-fire was lighted at Minisink [about 10 miles south of Maghackemek, New Jersey]." The Unami joined the Munsee on the south, somewhere about Stony Point. Going farther than this, Rutenber gives (p. 93 et seq.) the various subdivisions of the Munsee along the Hudson and their location: the Waoroneck, about Dans-kammer; the Warranawonkong, from Dans-kammer to Saugerties; the Mamekoting west of Shawangunk mountains; the Wawarsink, in the district which still bears their name; the Katskills, north of Saugerties.

had "chosen to live back of the two other tribes and formed a kind of a bulwark for their protection. . . . They extended their settlements from the Minnisink, a place named after them, where they had their council seat and fire, quite up to the Hudson on the east, and to the west or southwest far beyond the 'Susquehannah'; their northern boundaries were supposed originally to be the heads of the great rivers Susquehannah and Delaware, and their southern boundaries that ridge of hills known in New Jersey by the name of Musconuncun, and in Pennsylvania, by those of Lehigh, Cohnewago, etc."¹

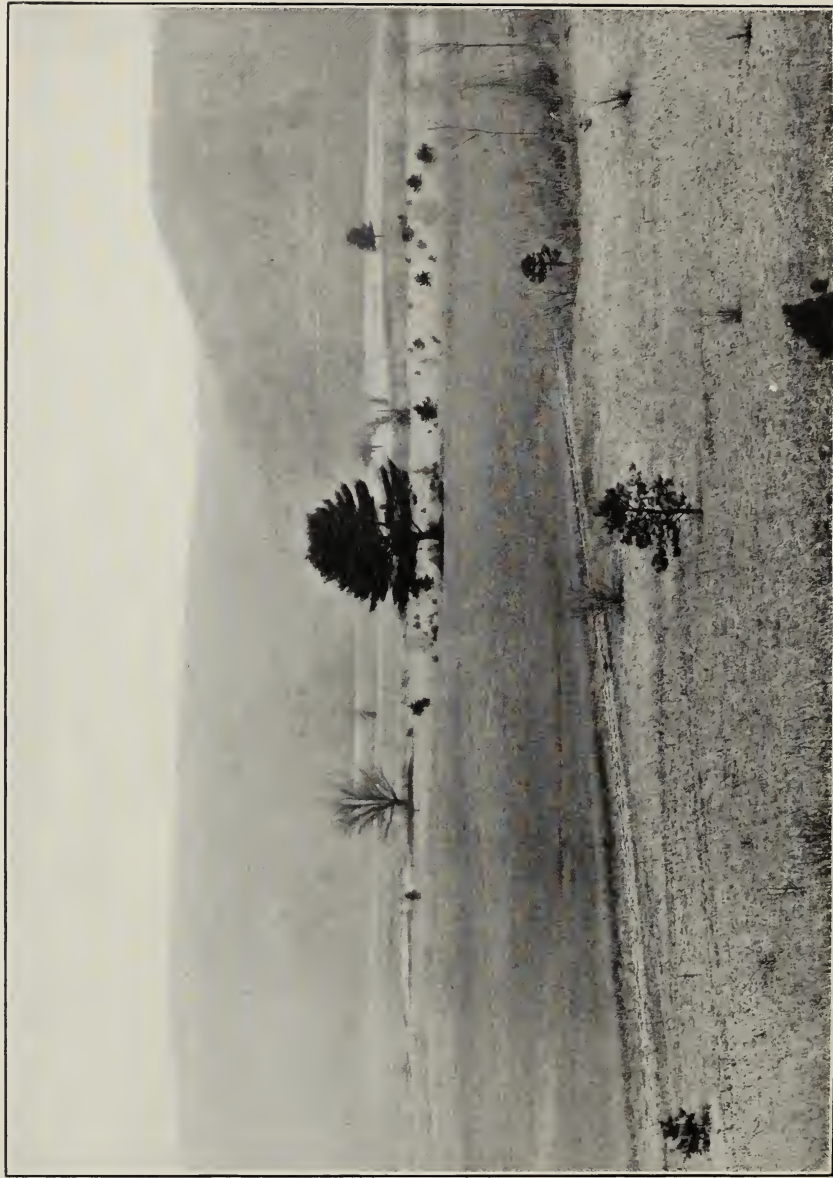
This is evidently one of the rare instances in which it is possible to make a clear tribal identification of older skeletal remains in eastern North America, and it is also an instance in which the contents of graves enable a fairly close estimate of the age of the site. The artifacts found with the various burials include a number of objects introduced by early settlers, a fact that shows the cemetery to be of historic date. Furthermore, one of the skeletons is that of a tall white man of Scandinavian or Nordic type, possibly one of the Dutch, English, or Swedes who reached the upper valley after 1614. As the remainder of the skeletons do not indicate any trace of admixture of white blood, the cemetery may be regarded as dating from the period of the earlier contact of the Indian and Caucasian races, or probably from the latter part of the seventeenth or the beginning of the eighteenth century. It was surely earlier than 1740, for in that year the main body of the Munsee was forced to move from the Delaware, settling first on the Susquehanna and soon after on the Allegheny River in Pennsylvania, where some of them had gone as early as 1724.

An event of anthropological importance in connection with the Munsee before their removal from the Delaware is noted by Ruttenber.² In the latter part of the seventeenth century, at the outbreak of hostilities between the Five Nations and the French, the advance of the Iroquois in the south was being contested by the Shawnee, who at that time were also engaged in war with the Cherokee. "In the latter they [the Shawnee] suffered severely, and but for the timely aid of the *Mahicans* would have been destroyed. The *Lenapes* [Delawares] invited them to remove to their country; the invitation being accepted, the *Minsis* brought the matter to the attention of the government of New York, in September, 1692, on an application to permit their settlement in the Minnisink country. The council gave its assent on condition that they should first make peace with the Five Nations.³ This was soon effected, and the messengers departed, ac-

¹ Quoted from Hrdlička, *The Crania of Trenton*, op. cit., pp. 32-33.

² Ruttenber, *History of the Indian Tribes of Hudson's River*, p. 178.

³ "River Indians returned from a residence with the Shawanoes, brought with them some Shawanoes



GENERAL VIEW OF THE LOCALITY OF THE MUNSEE CEMETERY AT MINISINK, NEW JERSEY

accompanied by Arnout Vielle, an interpreter, and three Christians, to visit the country of the *Shawanoes* and consummate the transfer. . . . Captain Arent Schuyler visited the *Minnisinks* in February, and there learned that the Shawanoes were expected early in the ensuing summer. This expectation was realized."

From this it appears that between 40 and 50 years before their removal from the Delaware, the Munsee were joined by some Shawnee, which fact may explain certain peculiar conditions shown by the skeletal remains that will be considered in the following pages.

The mound or cemetery explored by the Museum of the American Indian was known for many years, and some human bones had been removed from it, especially by Doctor Dalrymple, who exhumed at least 15 skeletons, but unfortunately these have been lost to science.

CONDITION OF THE COLLECTION

GENERAL

As already stated, the collection from the Museum of the American Indian consists of 57 Indian skeletons, which range from nearly complete to such as are represented by only a few bones. Notwithstanding the fact that the condition of the material leaves much to be desired, many of the bones are sufficiently well preserved to afford fairly good data for study. The bones show neither vestiges of greenness nor traces of mineralization. There is no post-mortem deformation, except in a few detached bones of the skulls of infants. The color of the bones is predominantly brownish yellow, shading in some specimens to light dirty yellowish and in others to a darker brownish hue.

AGE AND SEX

Of the 57 individuals, 34 were adults and 23 (40 per cent) were adolescents or children. Among the adults the estimated ages of the individuals range from 24 to 70 years, and nearly half were 50 years or more. Young infants (first year) and fetuses are absent, having either been buried separately, or, more likely, had turned to dust, while the older, more substantial bones resisted disintegration. The cemetery was obviously one that served during a limited period as the communal burial place of a sedentary group of moderate population. The determination of the sex was facilitated by the good development of the sexual characteristics in the skulls, and by the presence of the pelvic and other bones of the skeleton. The results

who intended to settle with the Minnisinks, asking permission to that end. Council directed that the Shawanoes must first make peace with the Five Nations.—*Council Minutes*, Sept. 14, 1692."

show that the 34 adults were divided equally between the sexes, as might be expected in the case of the remains of adults in the cemetery of a peaceful population.¹

ARTIFICIAL DEFORMATION

A fact of considerable interest is the presence of artificial deformation in more than half of all the skulls preserved. In the majority of cases this appears to be a simple occipital, cradle-board flattening, but there are three or four instances in which there are plain traces of bilateral frontal compression, which indicates intentional deformation and suggests that all the posteriorly flattened skulls may possibly be of this variety, though the applied pressure failed in most cases to leave a distinct mark on the frontal bone.² The result of no such practice has been observed in any other part of the northern or middle Atlantic States, but deformation of exactly this type was common in Arkansas and Louisiana, as well as in the area to the northeastward.³ Among the crania of the earlier and somewhat more easterly Lenape reported by the writer⁴ to the number of 25, only two (both females) showed slight occipital flattening. These facts are significant and point either to some difference in derivation between the Munsee and other Lenape and eastern Algonquian tribes, or, if of common derivation, to a connection between the Munsee and some people from the Trans-Appalachian region to the southwestward. It is in this connection that the historic accession to the Munsee of some Shawnee is suggestive, for the latter, or a part of them, lived in Kentucky and Tennessee, where the practice of fronto-occipital deformation was not uncommon, and in some parts of that area, indeed, was quite general.

PATHOLOGY

The bones in the collection are exceptionally free from the effects of injury and disease. The skulls exhibit no scars or injuries, and no disease, with the exception of a case of perforating mastoiditis in one of the children (no. 285,348). There is, however, as will be shown later, a considerable proportion of dental caries, with some indications of *pyorrhea alveolaris*.

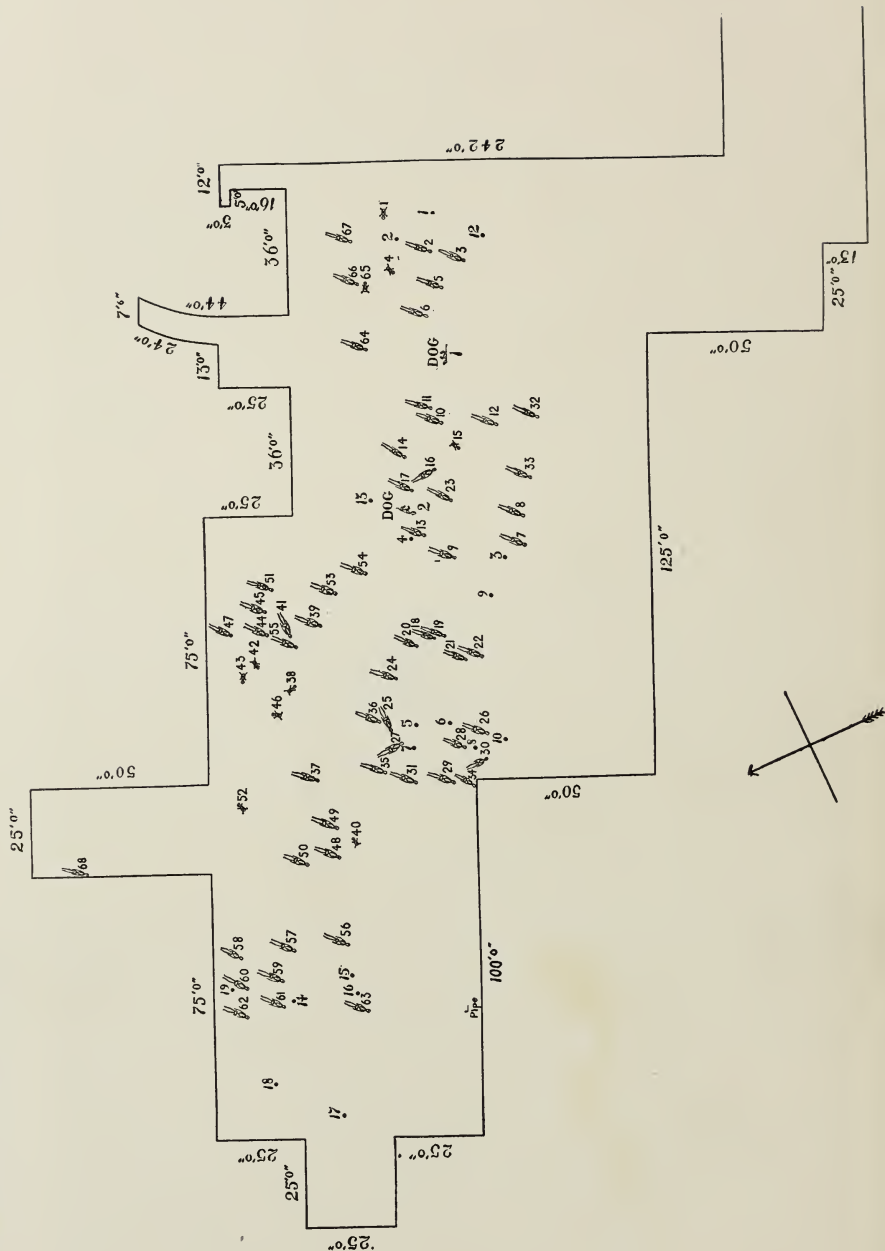
¹ Had the cemetery, prior to its disturbance, contained the remains of as many as 200 bodies of all ages, including infants, with a yearly mortality in the tribe of 35 per thousand, it could have been in use only about 60 years by a population of 100, and proportionately less, of course, for a larger group.

² As happened frequently on the coast of Peru, for instance, where the same type of deformation was practiced. No board was used in these instances, the frontal compression being effected by means of pads.

³ Report on a Collection of Crania from Arkansas, *Journal of the Academy of Natural Sciences of Phila.*, xiii, 558-563, Phila., 1908; Report on an Additional Collection of Skeletal Remains from Arkansas and Louisiana, *ibid.*, xiv, 1909, pp. 173-240, 9 figs.; Report on Skeletal Remains from a Mound on Haley Place, near Red River, Miller County, Ark., *ibid.*, xiv, 1912, pp. 639-640; Report on a Collection of Crania and Bones from Sorrel Bayou, Iberville Parish, La., *ibid.*, xvi, 1913, pp. 95-100.

⁴ *The Crania of Trenton*, op. cit., 1902.

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In the remaining bones of the skeletons the only marks of injury or disease are as follow:

Humeri (total number present, adults,¹ 56):

Left bone of no. 285,307: Old surface injury involving lower fourth of external border, with formation of some callus and a peculiar foramen (pl. 23).

Right bone of no. 285,303: Complete ankylosis with ulna, at right angle, possibly as a result of an early fracture of the olecranon (pl. 24).

Both humeri of no. 285,320: Some periostitis on distal third.

Both humeri of no. 285,306: Osteoperiostitis, distal half.

Radii (total number, adults, 45):

Both bones of no. 285,320: Some osteoperiostitis over distal half.

Ulnæ (total number, adults, 44):

Left bone of no. 285,306: Moderate osteoperiostitis, lower bone (right healthy).

Femora (total number, adults, 60):

Pair, no. 285,306: Moderate osteoperiostitis, distal half.

Right bone of no. 285,336: Some osteoperiostitis, distal half (left healthy).

Right bone of no. 285,320: Moderate osteoperiostitis, distal half (left healthy).

Right bone of no. 285,313: Marked "mushroom head" (arthritis deformans); left healthy.

Left bone of no. 285,321: Moderate "mushroom head."

Tibiæ (total number, adults, 58):

Right bone of no. 285,301: Trace of periostitis at middle (left healthy).

Right bone of no. 285,303: Slight osteoperiostitis on external surface, middle third (left healthy).

Right bone of no. 285,306: Osteoperiostitis, proximal half (left healthy).

Left bone of no. 285,313: Moderate localized osteoperiostitis, middle (right healthy).

Right bone of no. 285,336: Moderate osteoperiostitis, middle three-fifths (left healthy).

Left bone of no. 285,309: Trace of periostitis (right healthy).

Pair of no. 285,320: Osteoperiostitis.

Left bone of no. 285,321: Slight arthritis, upper articular surface (right healthy).

Fibulæ (number present, adults, 51):

Pair, no. 285,320: Osteoperiostitis.

¹ The bones of the children show nothing pathological.

Clavicles (present, 44):

Pair, no. 285,305: Moderate osteoperiostitis.

Right, no. 285,320: Osteoperiostitis.

Sternum (present, 14):

Moderate arthritic changes in nos. 285,305, 285,309, and 285,314.

Scapulæ (present, 25): Nothing pathological.*Ribs* (present, 420):

No. 285,305: Two long ribs fractured, well healed.

No. 285,309: One long rib fractured.

In addition, most of the ribs of nos. 285,305 and 285,333 show traces of arthritis.

Spine (of 25 individuals, mostly complete):

No. 285,305: Some marginal exostoses (arthritic) in the cervical and lumbar regions.

No. 285,306: Moderate arthritic exostoses, lumbar region.

No. 285,333: Advanced spondylitis deformans, involving parts of dorsal and whole lumbar region with sacrum, synostosis.

No. 285,319: Moderate arthritic exostoses on nearly all.

No. 285,311: Moderate arthritic exostoses.

No. 285,320: Moderate arthritic exostoses.

No. 285,328: Moderate arthritic exostoses in cervical and lumbar regions.

Pelvic bones (of 20 individuals):

No. 285,321, right: Some marks of arthritis about acetabulum.

Bones of the hand (number, 774):

No. 285,303: Carpal bones of right all damaged, crushed, and fused with third metacarpal.

No. 285,320: One of the carpals crushed in life.

Bones of the feet:

Os calcis (number, 61): Nothing pathological.

Astragalus (number, 58): Nothing pathological.

Other bones (number, 537):

No. 285,321: Right scaphoid, arthritis (left healthy).

No. 285,326: First right metacarpal diminutive (may have been injured in early life).

Patellæ (number, 38):

Pair of no. 285,329: Slight arthritis.

A summary of the above details shows that there are only six, possibly seven, instances of more noteworthy injury, and of these three pertain to ribs (two in one person) and two to the wrist. These are very moderate proportions of traumatism, and show plainly that the people represented by the remains led unusually peaceful lives.

As to disease, there is evidence of only four conditions, namely: Periostitis, osteoperiostitis, arthritis, and arthritis deformans; and of



TWO TYPICAL MUNSEE BURIALS IN MODERATELY CONTRACTED POSITION

these four the first two and again the last two are closely related, being really only degrees or varieties of the same processes. It is quite possible that all four conditions are merely differing manifestations of arthritis. There is no well-founded suspicion of the existence of syphilis in the tribe, and there is no trace of either rachitis, tuberculosis, or tumors of the bones. (Dental caries will be referred to under Teeth.)

We may now approach the more strictly anthropological observations.

THE CRANIA

GENERAL OBSERVATIONS: DIFFERENCES IN TYPE

Although the remains comprise seventeen adult males and the same number of females, some of the skulls are so defective that measurements and notes of value could be made only on those of ten males and thirteen females.

In examining and arranging these specimens, the first realization of importance is that, while the majority clearly belong to one type, there are a few that must be classed apart. The main type, as will be noted later and more plainly from the measurements, is that characterized by dolichocephaly to mesocephaly, and agrees with that prevalent among other Lenape as well as other Eastern tribes. The additional type is brachycephalic. Among the twenty-five skulls of adults there are four of the brachycephalic type, all females. A few additional examples existed evidently among the children; and several of the remaining skulls may be transitional as a result of admixture. The brachycephaly is so marked that it can not be due to normal individual variation within the series, and if we exclude this possibility the only remaining conclusion is that the broad-heads could not have been Lenape, except by adoption. The individuals represented by these skulls might have come from western Pennsylvania, where brachycephaly seems to have prevailed at least in some districts; or from farther southwestward, from a region to which points the intentional deformation among the "Munsee" crania. These possibly represent the Shawnee, who came from that section and who, according to growing indications, while speaking Algonquian were of a different type physically.

The admixture of this type existed evidently also among other branches of the Lenape, and to a more limited extent among various other tribes of the Atlantic states. The writer called attention to this mixture in 1902,¹ and will return to the subject in the second part of this memoir, which deals with Eastern skulls in general.

¹ *Crania of Trenton*, op. cit.

CHIEF DESCRIPTIVE FEATURES

The skulls are of good size, but otherwise are characterized by moderate development. There is no massiveness, no heavy supra-orbital arches or crests, no heavy jaws. It is plain that they did not belong to a tribe of great hunters or warriors.

The frontal region, though prevalently somewhat low in the females, in a large majority of the cases is well arched; the zygomæ are not excessively broad, the malar bones not heavy. The nose is rather short, the face only mildly prognathic. The dental arches, as in the majority of Indians, are very regular, and the same applies to the medium-sized teeth. The vault of the skull from above is either ovoid (58 per cent) or elliptical (42 per cent), while the outline of the norma posterior approaches more or less the pentagonal.

In addition there may be mentioned an unusual scarcity of Wormian bones and an equal sparsity of marked anomalies. These and other features are treated in detail in another part of this paper. (See pp. 35, 47.)

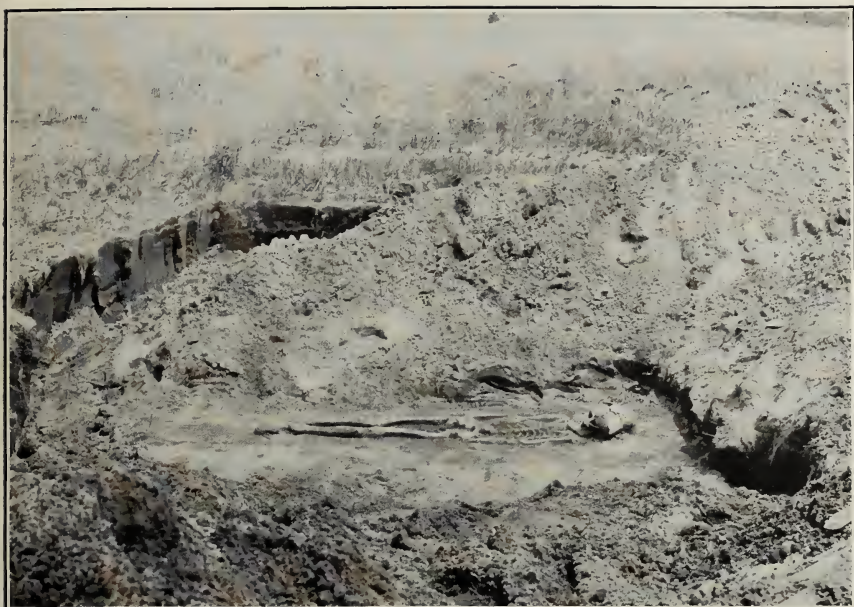
MEASUREMENTS

The measurements¹ offer many points of interest, although, so far as the vault is concerned, they are considerably interfered with by artificial deformation in some of the specimens. As in certain former reports by the writer, they will be dealt with in order according to their significance.

FORM OF THE VAULT

The measurements relating to the form of the vault comprise the maximum length and breadth, and the basion-bregma height, with the resultant percentage-relations or indexes. The details are given in the accompanying table. Although the number of undeformed specimens in good condition is small, it will be seen (*a*) that there is an absence of extremes in the several dimensions, (*b*) that the crania range in type from dolichocephalic to mesocephalic, and (*c*) that they show good height. As a result of the latter, both the height-length and the height-breadth indices are high, though corresponding well with those of many other Indian tribes and those of numerous other branches of the yellow-brown race. Comparisons will be found in the second part of this report, which deals with the Eastern Indians in general.

¹ All measurements presented in this report were taken personally by the writer, with proved instruments and due care. Unless otherwise noted, the methods follow strictly the international agreements of Monaco and Geneva.



TWO BURIALS IN EXTENDED POSITION

The lower burial is of special interest as showing how much of a skeleton may be decayed or scattered without disturbance of the remainder

I. MUNSEE CRANIA: MEASUREMENTS RELATING TO THE FORM OF THE VAULT *

MALES

Cat. No., U.S.N.M.	Deformation	Length, maxi- mum	Breadth, maxi- mum	Height (basion- bregma)	Cephalic index	Height- length index	Height- breadth index
		(a)	(b)	(c)	$\frac{b \times 100}{a}$	$\frac{c \times 100}{a}$	$\frac{c \times 100}{b}$
285,303.....	(Slight asymmetry)	cm. 18.9	cm. 13.3	cm. 14.2	70.4	75.1	106.8
285,308.....	.....	19.8	14.6	13.8	73.7	69.7	94.5
285,306.....	.....	18.7	14	14	74.9	74.9	100.0
285,313.....	.....	18.8	14.4	13.7	76.6	72.9	95.1
285,326.....	Slight occipital flattening.....	(17.7)	(13.7)	(14.4)	.....	.....	.....
285,301.....	Moderate occipital flattening.....	(17.8)	(15.1)	(14.6)	.....	.....	.....
285,305.....	do.....	(17.0)	(14.6)	(13.7)	.....	.....	.....
	Averages of unde- formed.....	(4) 19.05	(4) 14.1	(4) 13.9	(4) 73.9	(4) 73.1	(4) 98.9

FEMALES

285,309.....	.....	18.2	13.3	13.1	73.1	72	98.5
285,327.....	.....	17.6	13.1	12.4	74.4	70.5	94.7
285,307.....	Trace of fronto-occipital flat- tening †.....	16.9	13	12.9	76.9	76.3	99.2
285,320.....	.....	17.4	13.4	13	77	74.7	97
285,347.....	.....	18	14	13	77.8	72.2	92.9
285,302.....	Moderate occipital flattening.....	(16.0)	(14.1)	(13.2)	.....	.....	.....
285,304.....	do.....	(16.6)	(14.3)	(14.2)	.....	.....	.....
285,310.....	do.....	(16.9)	(14.4)	(14.2)	.....	.....	.....
285,321.....	Marked occipital with slight frontal flattening.....	(16.4)	(14.5)	(14.2)	.....	.....	.....
	Averages of unde- formed.....	(5) 17.6	(5) 13.4	(5) 12.9	(5) 75.8	(5) 73.1	(5) 96.4

* Arranged on the basis of the cephalic index.

† Not sufficient to vitiate the measurements.

Attention may be called to the lower value of the average cephalic index and the higher value of the average height-breadth index in the males than in the females. These conditions, due to the relatively greater length and also to the relatively greater height of the male skull, are not exceptional and will later be found to be quite general among Eastern Indians.

The identical value of the average height-length index in the two sexes is of no special significance and is probably incidental.

In the deformed skulls we see the usual effect of the flattening by the lessening of the length and a compensatory increase in both breadth and height.

SIZE OF THE SKULL

The principal determinations relating to the size of the vault are the cranial module or mean diameter, the capacity, the circumference, and the antero-posterior arc, all of which are given in the next table, where also is shown the thickness of the skull, which is of importance as a corrective to the external dimensions.

II. MUNSEE CRANIA: MEASUREMENTS RELATING TO THE SIZE OF THE VAULT *

MALES

Number	Capacity †	Cranial Module L+B+H	Circum- ference maximum (above supra- orbital ridges)	Nasion- opisthion arc	Thickness of left parietal (1 cm. above and along squamous suture)
		3			
	c. c.	cm.	cm.	cm.	min.
285,326.....	1,470	15.27	49.3	36.2	4
285,306.....	1,505	15.57	51.5	36.6	4.5
285,303.....	1,515	15.47	51.7	38.3	5.5
285,301.....	1,515	15.83	51	36.9	6.5
285,305.....	1,530	15.10	49.4	35.2	5.0
285,313.....	1,550	15.63	51.3	37.1	5.5
285,308.....	1,720	16.07	55	39.5	4
	(7)	(7)	(7)	(7)	(7)
Averages.....	1,544	15.56	51.3	37.1	5

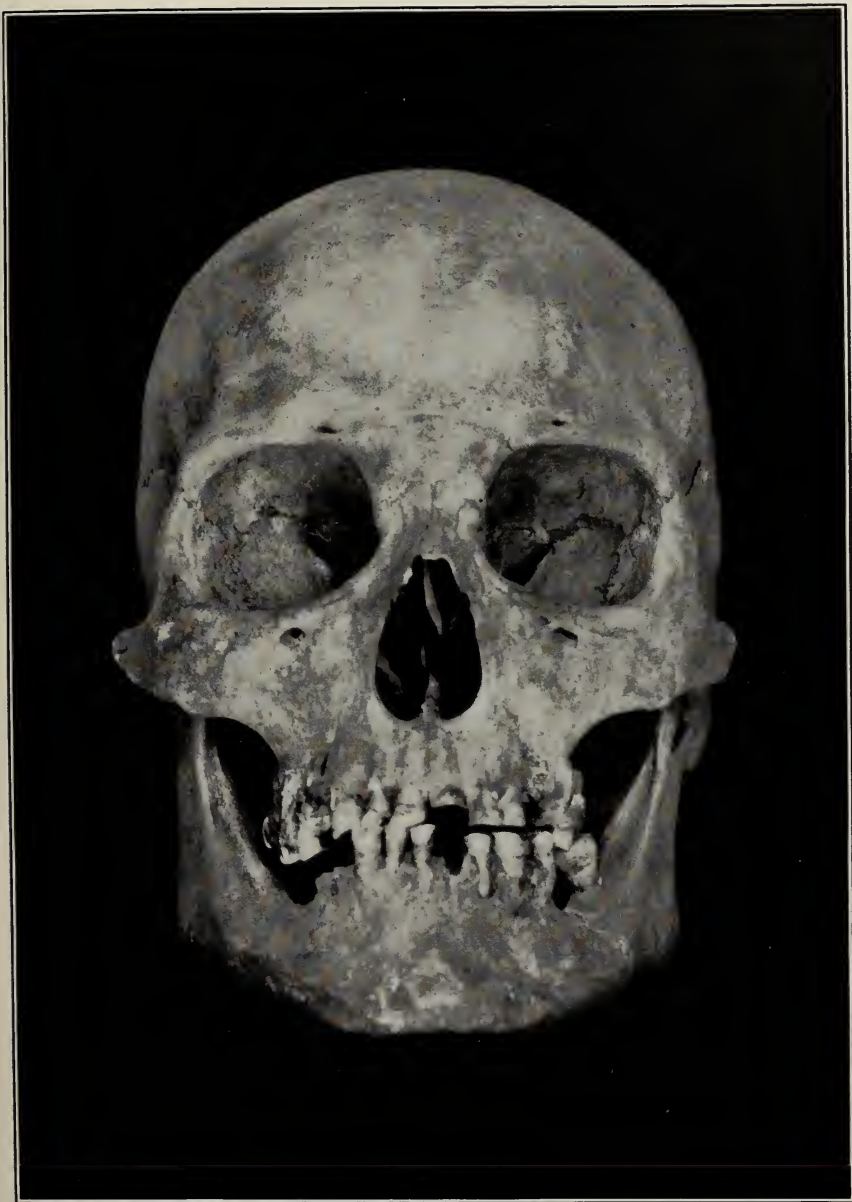
FEMALES

285,327.....	1,225	14.37	48.5	34.9	3.5
285,307.....	1,240	14.27	47.6	33.9	3.5
285,347.....	1,265	15.0	50.2	35.1	5.5
285,320.....	1,280	14.60	48.2	35.0	4.0
285,304.....	1,275	15.03	48.7	33.3	5.0
285,302.....	1,295	14.43	47.9	33.8	4.0
285,309.....	1,300	14.87	50.1	36.3	4.0
285,321.....	1,310	15.03	48.7	34.0	5.0
285,310.....	1,375	15.17	49.3	35.0	5.0
	(9)	(9)	(9)	(9)	(9)
Averages.....	1,285	14.75	48.8	34.6	4.4

* Arranged on the basis of capacity.

† Measured with dry mustard-seed and by the writer's method described in *Science*, xvii, 1903, pp. 1011-1014.

It will be noted that the measurements of the Munsee skulls, particularly those of the males, show fair capacity as well as external size of the vault, and also that only a few of the crania are thick-walled. An interesting feature is the unusual superiority of the measurements of the males over those of the females. This in a measure is due to the occurrence among the males of one skull of extraordinary size (1,720 c. c.); but even if we exclude this, the difference between the two sexes is somewhat greater than among other Indians. In the following table are given a few comparative data on this point.



MALE MUNSEE SKULL, NO. 285,303, U.S.N.M. (FRONT VIEW)

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III. RELATION OF AVERAGES OF MEASUREMENTS RELATING TO SIZE OF VAULT IN MALES AND FEMALES

(Males=100)

Group	Number of specimens		Capacity	Module	Circumference	Nasion-opisthion arc	Thickness
	Males	Females					
Arkansas*.....	19	14	86.5	96	96	96.5	92.5
Louisiana*.....	12	7	89.5	96	97	98	88
Munsee (excepting no. 285,308)...	6	9	85.0	95.5	96	94.5	88

* From A. Hrdlička, Report on an Additional Collection of Skeletal Remains from Arkansas and Louisiana, *Jour. Acad. Nat. Sci. Phila.*, xiv, 1909, pp. 171-249.

These data are of interest in a number of additional particulars. In the first place, it is seen that, barring capacity, a striking similarity exists in the relation of female to male measurements in the different groups of Indians. There are reasons to believe that such resemblances are not confined to these tribes alone or even to Indians generally, but extend, with a limited range of variation, to all races.

Another remarkable fact is that the external measurements of the skull, especially the mean diameter or module, and the circumference show practically identical percental relations in the two sexes, averaging each about 96 for the female to 100 for the male; while in capacity the difference is decidedly greater (less than 90 to 100) in favor of the male, notwithstanding the fact that the thickness of the female skulls averages smaller. In other words, a female skull only nine-tenths as thick as that of a male and which gives external measurements that compare with those of the male cranium in a ratio of 96 to 100, will stand in respect to its internal capacity toward the male skull as only 88 or 89 to 100. The cause of this must be attributed to the unequal build, in the two sexes, of those parts of the skull which are not reached by the ordinary external measurements, and the narrower and especially the lower frontal region in the female plays probably a large part in this connection.

RELATION OF SIZE OF SKULL TO STATURE

The size of the head, as is well known, increases with stature. This increase is not uniform, but progresses in a diminishing ratio. The fact holds true in all races, though the exact values of the ratio with the different racial elements have not as yet been determined definitely. In the case of skeletal remains, in which it is not possible to learn the exact stature, the most suitable manner of obtaining light on the subject is to compare the length of the femur with the cranial capacity, by which means we ascertain the number of cubic centimeters of the capacity that correspond to each centimeter of the length of the femur. The following data give the results of such

a comparison among the Munsee and on Indian skeletal remains from Arkansas and Louisiana.¹

IV. MUNSEE CRANIA: RELATION OF SKULL CAPACITY TO STATURE *

MALES

Number	Bicondylar length of right femur	Skull capacity	Femoro- cranial index (=c.c. of skull capacity per 1.0 cm. of femoral length)
	<i>cm.</i>	<i>c. c.</i>	
285,305.....	43.4	1,530	35.3
285,301.....	44.2	1,515	34.3
285,308.....	45.1	1,720	38.1
285,303.....	45.1	1,515	33.6
285,313.....	45.3	1,550	34.2
285,326.....	46.6	1,470	31.5
285,306.....	48.1	1,505	31.3
	(7)	(7)	(7)
Averages.....	(45.4)	(1,544)	(34.0)
Exclusive of 285,308.....	45.4	1,514	33.3

FEMALES

285,302.....	39.4	1,295	32.8
285,327.....	40.2	1,225	30.4
285,320.....	42	1,280	30.5
285,309.....	42.3	1,300	30.7
285,310.....	43	1,375	32.0
285,321.....	43.5	1,310	30.1
285,304.....	43.8	1,275	29.1
285,307.....	44.7	1,240	27.7
	(8)	(8)	(8)
Averages.....	42.4	1,288	30.4

COMPARATIVE DATA

MALES

Arkansas (5).....	45.1	1,446	32.1
Louisiana (7).....	44.4	1,434	32.3

FEMALES

Louisiana (5).....	41.7	1,330	31.9
--------------------	------	-------	------

* Arranged on the basis of stature (i. e., length of femur).

The results presented in the table show considerable individual variation in the femoro-cranial index, by reason of which there is some irregularity of alignment of the cases. This is especially true in regard to the capacity, which in this small series shows little

¹ Published by the writer in his *Report on an Additional Collection*, etc., op. cit., 1909, pp. 179, 188.

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MALE MUNSEE SKULL, NO. 285,303, U.S.N.M. (SIDE VIEW)

regularity or evidence of conformity with the aforementioned general rule of increase of the size of the head with stature. The tallest of the eight females had one of the smallest heads, and the man with the largest brain was not even of average height. However, there is no doubt that if the series of skulls was considerably larger, the usual progression, showing gradual increase in the size of the brain with the height of the body, would be apparent.

The femoro-cranial index progresses much more regularly than the capacity, and shows another well-known fact, also common to all human races, namely, that while the absolute size of the brain enlarges in proportion to the stature, its relative dimensions with reference to stature diminish as the latter increases; so that while the tall man or woman may be expected to have an absolutely larger brain than the average of his group, relatively to his stature he will have less brain matter than the short individuals of the same group.

The averages in the preceding table are interesting in another particular—i. e., the difference in the value of the femoro-cranial index in the two sexes. Both the former records of the Louisiana crania and those of the Munsee now presented show these indexes to be perceptibly lower in the females than in the males. The superiority in this respect among the male crania is seen not only in the averages, but practically throughout the records, seven of the eight indexes in the females being below the minimum of the indexes in the males. It seems evident that among the Indians the brain substance in the females is not only absolutely smaller than in the males, but is also somewhat smaller for each centimeter of stature, so that men of the same height as the women would still show an advantage in this particular. This advantage is not necessarily connected with mentality, but may be due to the greater muscularity of the males.

As to the value of the femoro-cranial index in different tribes, we can as yet say nothing positive. The indications are that if differences exist, they are not of a very pronounced character.

SIZE AND SHAPE OF THE FACE

The measurements chosen, as in the writer's work previously cited, are only the most essential. They include the total and upper length of face, and the three breadth measurements—the smallest breadth of the forehead, the greatest facial breadth in the plane of the zygomatic arches, and the breadth at the angles of the lower jaw. As to the total facial length (chin-nasion), wherever the teeth were worn due allowance for the wear was made on the basis of measurements on well-preserved teeth of the same sex and in the same group.

The results, presented in the next table, show that among the Munsee the face was of only fair height and that its other dimensions were rather subdued for Indians.

V. MUNSEE CRANIA: MEASUREMENTS RELATING TO SIZE AND SHAPE OF THE FACE *

MALES

Number	Total length of face (chin-nasion)† (x)	Upper length (prosthion-nasion) (y)	Breadth of face (diam. bizyg. max.) (z)	Facial index total $\frac{x \times 100}{z}$	Facial index upper $\frac{y \times 100}{z}$	Cephalic index of the skull (for comparison)	Diameter frontal minimum	Diameter bigonial
	cm.	cm.	cm.				cm.	cm.
285,303.....	11.8	6.8	13.7	86.1	49.6	70.4	9.3	11
285,306.....	12.2	7.0	13.9	87.8	50.4	74.9	9.5	11.9
285,326.....	12.1	6.9	13.6	89.0	50.7	(‡)	8.7	10.6
285,313.....	12.0	7.2	14.0	85.7	51.4	76.6	9.0	9.5
285,308.....	12.6	7.4	14.2	88.7	52.2	73.7	10.1	11.1
285,305.....	12.1	7.2	13.6	89.0	52.9	(§)	9.6	9.5
285,301.....	12.3	7.6	14.2	86.6	53.5	(§)	9.5	9.3
	(7)	(7)	(7)	(7)	(7)		(7)	(7)
Averages.....	12.15	7.15	13.9	87.6	51.5		9.4	10.4

FEMALES

285,310.....	11.9	7.0	13.6	87.5	51.5	(§)	9.8	10.3
285,327.....	11.2	6.6	12.4	90.3	53.2	74.4	8.4	8.7
285,302.....	11.9	7.0	12.8	93.0	54.7	(§)	9.3	9.8
285,307.....	(?)	6.8	12.4	.....	54.8	76.9	8.5	.....
285,304.....	11.8	7.3	12.9	91.5	56.5	(§)	9.4	9.6
	(4)	(5)	(5)	(4)	(5)			
Averages.....	11.7	6.9	12.8	90.5	54.1		9.1	9.6

* Arranged on the basis of the Upper Facial Index.

† Where teeth were worn off, due allowance was made for the defect, the normal enameled portion of median incisors in apposition being taken as 19 mm. high, in the men.

‡ Slightly deformed.

§ Deformed.

The bizygomatic breadth, though not really small, is below the average in many other tribes of Indians, while the frontal breadth and that of the lower jaw are also somewhat below the medium. These results bear out the statement made under "General Observations" (p. 20) relative to the moderate proportions of the face of the Munsee. Comparative data given in the second part of this report indicate that in some of these respects, especially in the height of the face, the Munsee were somewhat exceptional among the Eastern tribes.

The facial indexes indicate mild chamæprosopy to mild leptoprosopy. Both the total and the upper indexes are perceptibly higher in the females, which on analysis of the measurements is seen to be due to the relatively greater narrowness of the face in the female, which, in turn, is doubtless connected with a relatively smaller development of the temporal muscles, the main muscles of mastication. The same condition was noticeable in the crania from Arkansas and Louisiana previously reported by the writer, and is probably quite general among Indians. Some of the foreheads and some of the lower jaws among the Munsee, as will be seen from the details, were relatively quite narrow.



MALE MUNSEE SKULL, NO. 285,303, U.S.N.M. (VIEW FROM ABOVE),
SHOWING TYPICAL FEATURES

— IV
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ORBITS. NOSE

With respect to the orbits, the writer follows his invariable custom of making measurements on both sides and recording the mean, which, in turn, gives rise to a mean index. This procedure is necessary in view of the fact that in only a minority of cases are the two orbits of equal dimensions and that sometimes they differ considerably.¹

Among the series of Lenape crania which the writer reported on in 1902,² there were several specimens in which the orbits were unusually low. At that time it seemed as if this feature might be almost characteristic of these Indians; but evidently such is not the case, for low orbits are quite rare among the Munsee. As will be seen from the following figures, in only one instance (male, no. 285,313) are the orbits decidedly low and broad, giving the microseme³ index of 78.1. Of the remaining cases four males and two females (43 per cent) are mesoseme, while two of the males and five of the females (50 per cent) are megaseme. The extensive fluctuation of the orbital index in both sexes of the Munsee tribe is very striking, but much the same variation was observed in the Arkansas and Louisiana crania previously mentioned, and is present among the Eastern tribes in general.

VI. MUNSEE CRANIA: ORBITS,* NOSE †

MALES

Orbits				Nose			
Number	Mean height (a)	Mean breadth (b)	Mean index $\frac{b \times 100}{a}$	Number	Height	Breadth	Index $\frac{B \times 100}{H}$
	cm.	cm.			cm.	cm.	
285,313.....	3.2	4.1	78.1	285,303	5.0	2.2	44.0
285,308.....	3.4	3.95	86.1	285,326	5.0	2.35	47.0
285,303.....	3.4	3.9	87.2	285,301	5.45	2.6	47.7
285,305.....	3.6	4.05	87.2	285,305	5.0	2.5	50.0
285,306.....	3.35	3.75	89.3	285,308	5.3	2.8	52.8
285,326.....	3.3	3.6	91.7	285,306	5.0	2.9	58
285,301.....	3.6	3.9	92.9	285,313	5.15	3.0	58.3
	(7)	(7)	(7)	.....	(7)	(7)	(7)
Averages.....	3.4	3.9	87.5	.....	5.1	2.6	51.1

* Arranged on the basis of the Orbital Index.

† Arranged on the basis of the Nasal Index.

¹ It seems advisable to mention at this point the exact method used by the writer in the measurement of the orbits, for there appears to be not a little discrepancy in this respect among different workers. The measurements are those of Broca: The breadth is from dacryon (the point of intersection of the lachrymo-frontal suture and the sharp free orbital border of the lachrymal canal) to the most distal part of the lateral boundary of the orbit, below the malo-frontal suture; while the height is the maximum height, from about the center of the lower border of the orbit. Both dimensions can be taken with fair accuracy by either a graduated rod or by the two sharp points of the *compas glissière*. The main point is that the measurements should not comprise any part of the borders of the orbits, particularly the outer one, which differs considerably in thickness and breadth, and part of which seems not infrequently to be included by those who take these measurements.

² *Crania of Trenton*, etc., op. cit.

³ Broca's classification.

VI. MUNSEE CRANIA: ORBITS, NOSE—Continued

FEMALES

Orbits				Nose			
Number	Mean height (a)	Mean breadth (b)	Mean index $\frac{b \times 100}{a}$	Number	Height	Breadth	Index $\frac{B \times 100}{H}$
	<i>cm.</i>	<i>cm.</i>			<i>cm.</i>	<i>cm.</i>	
285,321.....	3.3	3.8	86.8	285,304	5.3	2.5	47.7
285,310.....	3.4	3.85	88.3	285,302	4.9	2.4	49
285,307.....	3.5	3.85	90.3	285,347	5.0	2.5	50
285,309.....	3.3	3.65	90.4	285,309	4.9	2.6	53.1
285,327.....	3.4	3.6	94.4	285,310	5.0	2.7	54
285,304.....	3.5	3.7	94.6	285,327	4.8	2.6	54.2
285,302.....	3.55	3.65	97.9	285,320	4.9	2.7	55.1
				285,307	4.8	2.7	56.3
				285,321	5.2	3	57.7
	(7)	(7)	(7)		(9)	(9)	(9)
Averages.....	3.4	3.72	91.7		5.0	2.65	52.9

The average orbital index in the female Munsee is higher than that in the males, as is generally the case, a fact directly due to the heavier development of the supraorbital region in the males.

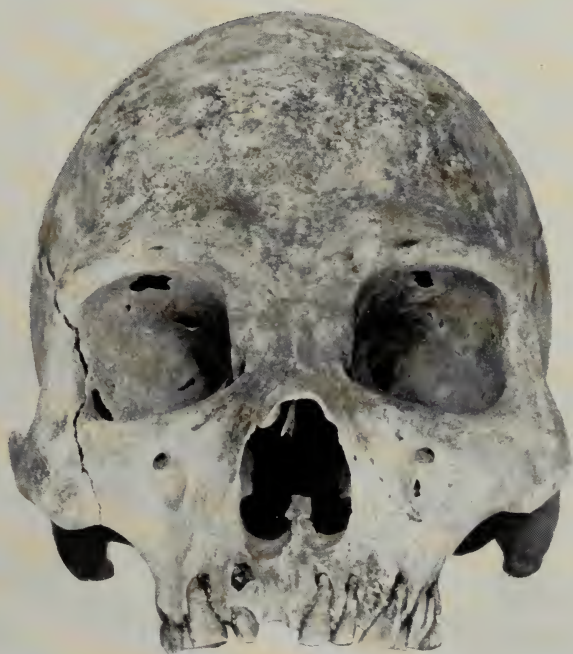
The *nose* in many of the individual Munsee, in conformity with the rest of the upper face, was rather short, but occasionally it was quite broad. The indexes, according to Broca's classification, give four instances (25 per cent; 3 m., 1 f.) of leptorhinc, four cases (25 per cent; 2 m., 2 f.) of mesorhinc, and eight cases (50 per cent; 3 m., 5 f.) of moderately platyrhinc nasal aperture, the averages falling both in mesorhiny. The usual accompaniments of platyrhiny in the negro nose, however, are invariably absent, the inferior borders of the aperture being moderately sharp and the bridge showing generally a fair development.

PROGNATHISM

Measurements relating to prognathism include three basal diameters, namely, from basion to prosthion, the subnasal point and nasion; and the subnasal (alveolar) height, with the heights from prosthion and the subnasal point to nasion. These lines connected give us, in skulls in which the facial parts are well preserved, the angle of the face as a whole and also the alveolar angle, which it is important to measure separately.

An extended and meritorious report on the naso-alveolo-basilar angle such as here described was published in 1909 and 1910 by Dr. P. Rivet,¹ who commenced its determination independently by the

¹ *L'Anthropologie*, xx, 1909, pp. 35 et seq., 175 et seq.; 1910, pp. 505, 637.



MALE SKULL, NO. 99-6669, A.M.N.H., FROM MANHATTAN ISLAND
(FRONT VIEW)

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VII. MUNSEE CRANIA: PROGNATHISM, FACIAL AND ALVEOLAR*

MALES

Number	Basion-prosthion line (a)	Basion subnasal point † (b)	Basion-nasion (c)	Prosthion-nasion height (d)	Prosthion-subnasal point height (e)	Facial angle (angle between a and d) °	Alveolar angle (angle between a and e) °
	cm.	cm.	cm.	cm.	cm.		
285,306.....	10.5	9.7	10.4	7	2.1	70	62
285,308.....	10.2	9.2	10.3	7.4	2.2	70	58
285,301.....	10	8.8	10.4	7.6	2.3	72	54
285,305.....	9.4	8.6	10.0	7.2	2.2	74	64
285,326.....	9.9	8.9	10.3	6.9	2.0	74	56
285,303.....	9.5	8.7	10.2	6.8	1.9	77	61
	(6)	(6)	(6)	(6)	(6)	(6)	(6)
Averages.....	9.9	9.0	10.3	7.15	2.1	73	59
285,307.....	10.4	9.2	10.1	6.8	2.1	69	52
285,327.....	9.4	8.4	9.7	6.6	1.9	74	55
285,302.....	9.0	8.0	9.6	7.0	2.2	74	58
285,304.....	10	9.0	10.5	7.3	2.1	74	58
285,310.....	9.4	8.4	10.2	7	2.1	76	58
	(5)	(5)	(5)	(5)	(5)	(5)	(5)
Averages.....	9.6	8.6	10	6.9	2.1	74	57

* Arrangement of cases based on Facial Angle.

† The "subnasal point" of the writer is the lowest point on the inferior border of the nasal aperture on the left side: it is the point from which the height of the nose is measured.

same method as that of the present writer and almost simultaneously with him; but no comparisons are as yet available in regard to the alveolar angle. It appears from Rivet's data that among modern white adults the average of the facial angle, as herein defined, ranges in round numbers from 70.5° to 73° ; ¹ among the negroes, the mean of Rivet's series gives 68.5° ; among several groups of American Indians it was 68° to 71.5° . Rivet calculated his indexes mathematically and with the help of an "abaque," while the writer obtained his results by the direct (graphic) method, which, for small series of calculations and used with precision, seems to him preferable, although the results are probably quite comparable. By this method the writer obtained on the Arkansas and Louisiana crania, previously reported, averages ranging for the facial index from 70° to 74° for the males, and 68° to 70° for the females; while the alveolar angle gave the average of 55° to 60° in the males, and 51° to 53° in the females. The Munsee crania give the rather high average of 73° for the males and 74° for the females, with respect to the facial angle, and 59° in the males with 57° in the females for the alveolar angle. These

¹ An exceptional group of Wends reached 76.5° .

figures indicate that both the facial and the alveolar protrusion in the Munsee was exceedingly moderate for a group of Indians, although in a measure the height of the indexes is due to the shortness of the face.

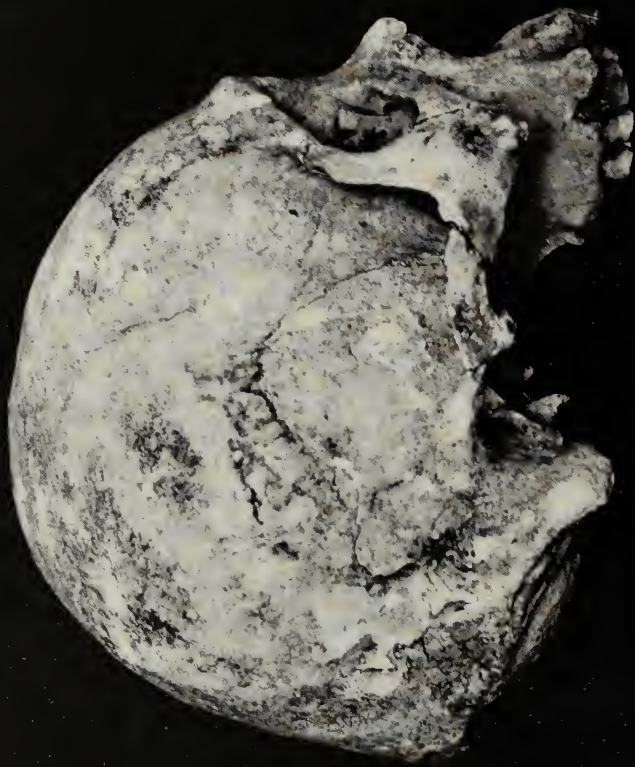
PALATE

It was possible to obtain satisfactory measurements of the palate (or, more strictly speaking, the upper alveolar arch) in 13 instances, which, in view of the usually frequent defects of the arch, is a good proportion of the cases. The measurements and indexes follow Turner's method, which is quite satisfactory.¹ The greatest length recorded by Turner in 20 European male and 8 European female skulls was 6 cm., the smallest 4.7 cm.; the greatest breadth 6.9 cm., the smallest 5.6 cm. The same measurements among the Munsee range, if we take both sexes together, from 5.1 cm. to 6 cm. for length and 5.9 cm. to 7.2 cm. for breadth, showing both dimensions, though more especially the breadth, to be slightly superior in these Indians to what they are in whites. The palatal or "uranic" index averaged, in Turner's whites, 116.2 in the males and 115.6 in the females; in the Munsee the averages are 120.7 for the former and 120.5 for the latter sex, showing the palate in these Indians to be more "brachy-uranic," or relatively broader. The sexual differences in both Turner's and the present series are so small as to be practically negligible. In the different groups of Arkansas and Louisiana crania, reported in 1909 by the writer, the average palatal index ranged from 116 to 122 in the males and from 115 to 122 in the females—conditions very similar to those shown in the present observations.

It may here be pointed out that the whole subject of the dimensions of the palate or alveolar arch in the different races, and especially in the different types of skull, needs investigation. As it is, the variety in the dimensions and shape of these structures, and especially their correlation with the rest of the face and skull, are only imperfectly understood.

¹ Length: "From the alveolar point to a line drawn across the hinder borders of the maxillary bones. Breadth: Maximum external just above the molar teeth."

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MALE SKULL, NO. 99-6669, A.M.N.H., FROM MANHATTAN ISLAND (SIDE VIEW)

VIII. MUNSEE CRANIA: PALATE;* LOWER JAW;** FORAMEN MAGNUM

MALES

Palate				Lower jaw						Foramen magnum	
Number	Length	Breadth	Index B × 100 L	Number	Height at sym- physist	Thick- ness at 2d left molar†	Diam- eter bigon- ial	Mini- mum breadth of ramus	Angle (mean)§	Number	Mean diam- eter $\frac{L+B}{2}$
	cm.	cm.			cm.	cm.	cm.	cm.	°		cm.
285,316	5.8	6.7	115.5	285,316	3.4	1.5	-----	3.7	-----	285,301	3.3
285,301	5.8	6.9	119	285,303	3.6	(¶)	11	3	120	285,305	3.3
285,306	5.7	6.8	119.3	285,305	3.6	1.3	9.5	3.5	117	285,303	3.5
285,315	6.	7.2	120	285,313	3.6	1.4	9.5	3.6	116	285,306	3.5
285,326	5.5	6.6	120	285,301	3.7	1.3	9.3	3.6	116	285,308	3.6
285,305	5.3	6.4	120.8	285,306	3.8	1.3	9.5	3.5	117	285,326	3.6
285,308	5.7	7.0	122.8	285,326	3.8	1.3	10.6	3.2	116	285,313	3.8
285,303	5.1	6.6	129.4	285,308	3.9	1.6	11.1	3.4	121	-----	-----
				285,315	3.9	1.8	10.9	4.0	121	-----	-----
Averages..	(8) 5.6	(8) 6.8	(8) 120.7		(9) 3.7	(8) 1.5	(8) 10.5	(9) 3.5	(8) 118		(7) 3.5

FEMALES

285,327	5.1	5.9	115.7	285,324	3.2	1.5	9.6	3.3	128	285,309	3.1
285,307	5.6	6.6	117.9	285,307	3.2	1.2	8.7	-----	127	285,327	3.1
285,304	5.2	6.2	119.2	285,310	3.4	1.6	10.3	3.5	131	285,304	3.2
285,302	5.2	6.4	123.1	285,321	3.5	1.65	-----	3.5	-----	285,310	3.2
285,310	5.2	6.6	126.9	285,347	3.5	1.6	-----	3.4	128	285,302	3.3
				285,302	3.7	1.5	9.8	2.8	140	285,320	3.3
				285,320	-----	-----	-----	3.1	123	285,347	3.3
				285,309	-----	-----	-----	-----	130	285,307	3.4
Averages..	(5) 5.25	(5) 6.35	(5) 120.5		(6) 3.4	(6) 1.5	(4) 9.6	(6) 3.2	(7) 130		(8) 3.2

* Arranged on the basis of the Palatal Index.

** Arranged on the basis of the height at symphysis.

† The vertical height in median line.

‡ Measured with the *compas glissière* in such manner that the center of the second molar or of its alveolus corresponds to the middle of the rod of the compass between the two branches which are applied to the ramus.

§ Measured with Broca's goniometer.

¶ Moderate.

FORAMEN MAGNUM

In respect to the foramen magnum, there is so much irregularity and so little special significance in the ratio between the two main diameters, length and breadth, that the writer prefers to use the mean measurement, $(\frac{L+br}{2})$, which stands in some relation to stature and probably to muscular development, and which may have more than passing interest in the study of racial and other groups. The average in the Munsee is, as usual, perceptibly higher in the males

than in the females. It is almost identical in both sexes with that of the Indian skeletal remains from the Louisiana mounds (Munsee, 7 males, 3.5; 8 females, 3.2; Louisiana, 10 males, 3.45; 14 females, 3.18 cm.), which were nearly alike in stature, but it is slightly superior to that of the Indians from Arkansas, who were also of practically the same height (Arkansas, 22 males, 3.3; 16 females, 3.14 cm.).

LOWER JAW

The measurements of the lower jaw show only moderate dimensions throughout. The angle (mean of the two sides, which usually differ somewhat in this respect) averages decidedly higher in the females (130°), which is not always the case in American crania. Thus among the Arkansas and Louisiana mound crania it averaged 118.5° in the males, or practically the same as in the Munsee; while it was only 122° in the females, or eight points lower than in the Munsee of the same sex.

DETAILED OBSERVATIONS ON THE CRANIA

In visual examination of a series of crania or other bones of more than passing importance, general impressions are not sufficiently accurate or reliable; consequently, the writer habitually makes detailed notes of the principal features of each specimen in accordance with a definite though simple scheme. Such notes can be tabulated and analyzed almost as readily as measurements.

In choosing the points for observation, the only rule that can be formulated is to include everything of consequence, and to cover the whole specimen, which is not so easily accomplished as at first might seem. Some of the points touched upon in such a procedure will, of course, be of much less weight than others, but they serve to complete the picture and will doubtless be of some interest and value in future comparisons; while purely individual characteristics that might be included by some authors may be passed entirely.

The results of the detailed examination of the Munsee crania are as follow:

THE VAULT: FOREHEAD

The conditions found in respect to the frontal region will be clearly seen from the accompanying table. As general among Indians, this region in the Munsee skulls shows high development only in exceptional cases. In the males there is frequently more or less of a slope; in the females, where slope is rare, low foreheads prevail.



MALE SKULL, NO. 99-6669, A.M.N.H., FROM MANHATTAN ISLAND
(VIEW FROM ABOVE), SHOWING LONG OVOID OUTLINE

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IX. MUNSEE CRANIA: FRONTAL REGION

	9 males		11 females	
	Cases	Per cent	Cases	Per cent
Exceptionally good development.....			1	9
Medium.....	5	56	4	36
Low.....	1	11	5	45
Slight to moderately sloping.....	3	33	1	9

SAGITTAL REGION

The vault of the skull among Indians is frequently more or less arched or keeled, indicating strong development of the temporal muscles. This characteristic is of course much more frequent and pronounced in the males than in the females. The Munsee, it will be seen, show no exception in this respect. The elevation of the sagittal region is present in nearly all the males, although it is seldom pronounced. Among the females nearly half are without sagittal elevation, while in the remainder this feature is only slightly developed.

X. MUNSEE CRANIA: SAGITTAL REGION

	9 males		12 females	
	Cases	Per cent	Cases	Per cent
Oval or nearly so.....	1	11	5	42
Slightly elevated or keeled.....	4	44	5	42
Moderately keeled.....	2	22	1	8
Markedly keeled.....	2	22	1	8

TEMPORO-PARIETAL REGION

The temporo-parietal region differs in convexity with the type of the skull, being usually quite flat in pronounced dilochcephaly and decidedly convex in marked brachycephaly. Besides this, it is also subject to individual and groupal variations. In the series at hand, in two-thirds of both the male and the female skulls the region is of about medium convexity. Among the remainder of the specimens it is rather interesting to note that while in a third of the cases in the males the region is flat and in no case bulging, these conditions are practically reversed in the females. The temporo-parietal region of the brain tended evidently to a greater relative development in the females of this series than in the males.

XI. MUNSEE CRANIA: TEMPORO-PARIETAL REGION

	9 males		12 females	
	Cases	Per cent	Cases	Per cent
Bulging.....			3	25
Medium convexity.....	6	67	8	67
Rather flat.....	3	33	1	8

OCCIPUT

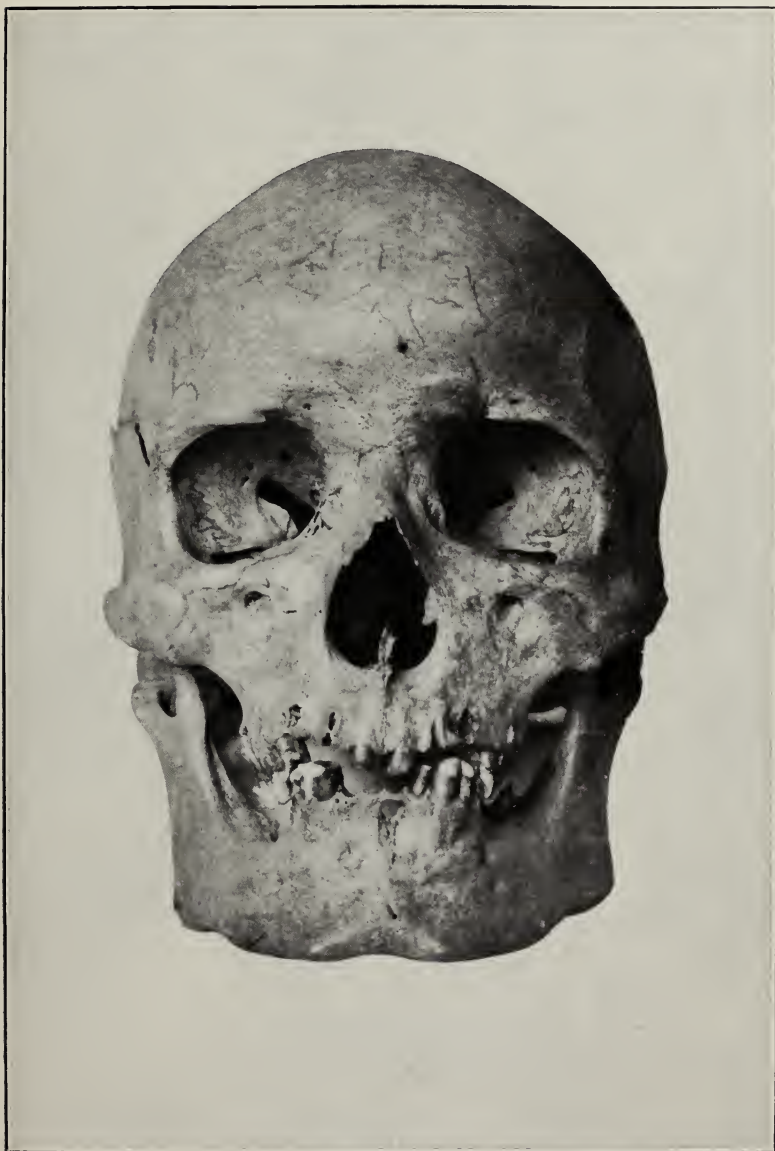
When we eliminate all the cases that show any trace of artificial flattening of the back of the skull, there remain only a few specimens for observation. Among these, three-fourths show medium convexity of the occiput, while in one-fourth the region is protruding. There is no difference in this respect in the two sexes. The external occipital protuberance and the occipital ridges do not show especially strong development in any case, and barring a single instance of the occurrence of an Inca bone, which will be spoken of in another connection, there are no anomalies of this region to be recorded.

XII. MUNSEE CRANIA: OCCIPUT (IN THE UNDEFORMED)

	4 males		4 females	
	Cases	Per cent	Cases	Per cent
Medium prominence.....	3	75	3	75
Protruding.....	1	25	1	25
Slightly asymmetric.....	1	(25)	1	(25)

SUTURES: SERRATION

The serration of the cranial sutures is of interest for the reason that in the skulls of whites and in superior skulls generally the knitting is often, though not invariably, quite complex, while in the majority of the skulls among the retarded races it is more or less simple and may occasionally be nearly absent. For the sake of simplicity in recording the nature of the sutures the writer refers to the serration as "medium," or about as it averages in whites; "submedium," which is self-explanatory; and "poor," or such as approaches a simple wavy line. Among the Indians the sutures range mostly from submedium to more simple, and the Munsee skulls form no exception. As seen from the actual data not one case reaches the standard of medium complexity in all the sutures, while in a large proportion of the specimens the serration of most, if not all, is decidedly inferior. No special difference exists in this respect between the skulls of different sizes.



MALE MUNSEE SKULL, NO. 285,308, U.S.N.M. (FRONT VIEW)

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XIII. MUNSEE CRANIA: SERRATION OF SUTURES

	7 males		11 females	
	Cases	Per cent	Cases	Per cent
Medium (about as average in whites).....				
All sutures of the vault submedium.....	2	29	5	45
All poor.....	2	29	5	45
Coronal and lambdoid submedium, sagittal medium	2	29	1	9
Coronal quite simple, sagittal and lambdoid nearly medium.....	1	14		

OCCLUSION OF SUTURES

In none of the specimens at hand can be detected any premature occlusion, though in this respect it is impossible to be certain as to the temporo-occipital articulations. Unfortunately, there is no possibility of giving the exact relation of age to the occlusion in any of the sutures; all that it is possible to determine is their relative involvement. The order among the males is S-C-TO-L;¹ that in the females, TO-S-C-L. It is plain that occlusions in the coronal and temporo-occipital sutures are almost as early and frequent as those in the sagittal, while those in the lambdoid are decidedly later. As to locality, the coronal suture occludes first below the temporal ridges; in the sagittal the commencement is most frequent, as usual, about obelion; in the lambdoid it is irregular; while in the temporo-occipitals in the Munsee it advances generally from the anterior or basal extremity of these sutures backward and upward.

XIV. MUNSEE CRANIA: OCCLUSION OF SUTURES (EXTERNALLY, ALL GRADES)

	9 males		12 females	
	Cases	Per cent of skulls	Cases	Per cent of skulls
Coronal.....	6	67	4	33
Sagittal.....	7	78	4	33
Lambdoid.....	2	22	2	17
Temporo-occipital.....	5	56	5	42

WORMIAN BONES

The frequency of Wormian bones in any given series of skulls, while a factor of no great importance, is always of some interest. It is certain that in this respect there is a wide difference even in different groups of the same people, such as the Indians. Among the Munsee, as already mentioned, we find a remarkable scarcity of these ossicles, especially in the males. Not only are the Wormian

¹ S=sagittal; C=coronal; TO=temporo-occipital; L=lambdoid.

bones scarce in this series, but they are also invariably small. This scarcity may in all probability be regarded as a sign of the absence of all disturbances, developmental as well as pathological.

XV. MUNSEE CRANIA: WORMIAN BONES; BREGMA AND "INCA" BONES

Total number present	8 males		12 females		According to sutures	8 males		12 females	
	Cases	Per cent	Cases	Per cent		Cases	Per cent	Cases	Per cent
None.....	3	38	4	33	Coronal.....	1	12	.....	.....
One.....	3	38	1	8	Sagittal.....	.....	.....	.....	.....
Two.....	1	12	1	8	Lambdoid.....	4	50	6	50
More than two.....	.....	.....	5	42	Temporo-occipital.....	.....	.....	6	50
Inca bone.....	.....	.....	1	8	Temporo-parietal (squamo-mastoid angle).....	2	25	2	17
Bregma (fontanel bone).....	1	12	.....	.....	.....	.....	.....	.....	.....

BREGMA AND INCA BONES

Among the 20 crania in which conditions with respect to these facts could be ascertained, there was found one bregma or fontanel bone (3x3.1 cm.), and one of the so-called Inca¹ bones (diameter, 8.3x3.5 cm.). There is nothing especially noteworthy in these occurrences, both of which, particularly the Inca bone, are of the nature of developmental anomalies.

Pterions.—Among the 19 Munsee skulls in which the pterions could be determined there was no case of temporo-frontal contact. In all instances the pterion was of the H type, predominantly narrow in the males and predominantly medium to broad in the females.

XVI. MUNSEE CRANIA: PTERIONS

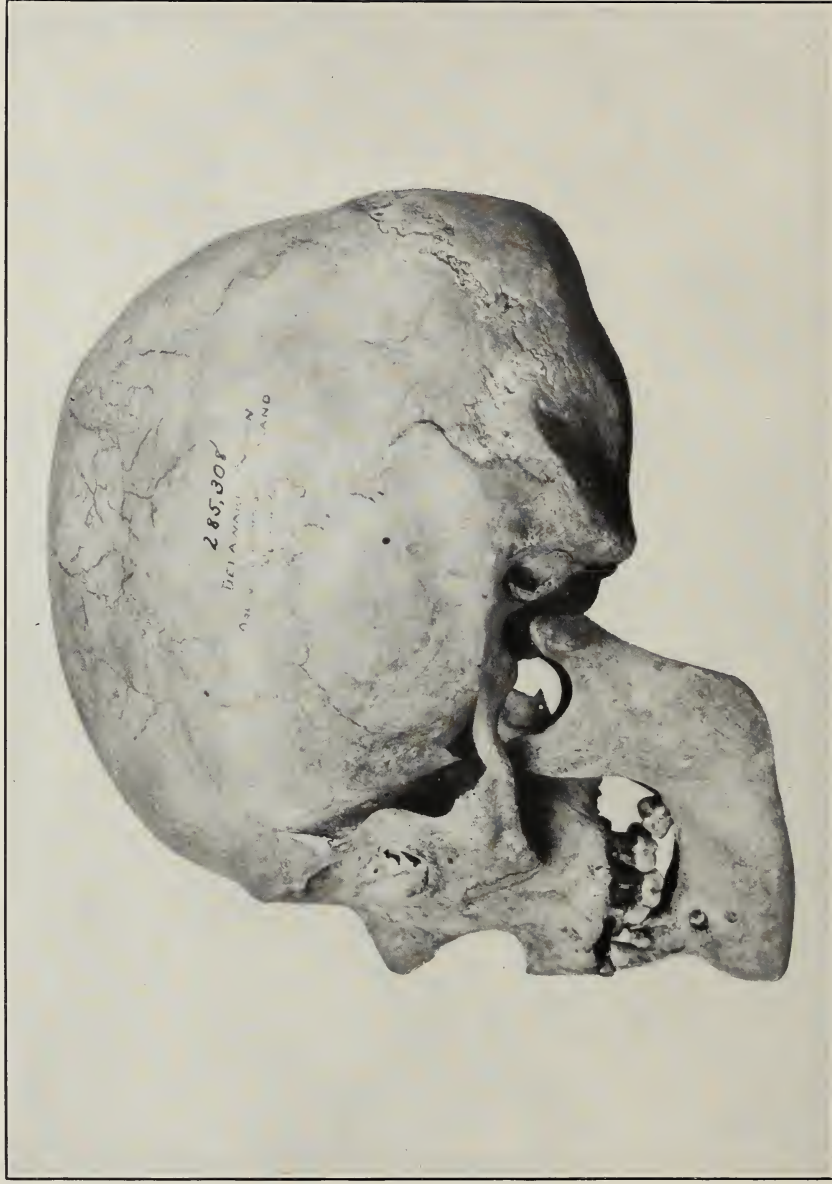
	7 males		12 females	
	Cases	Per cent	Cases	Per cent
Temporo-frontal contact.....	.....	.....	.....	.....
H type, narrow.....	4	57	1	8
H type, medium.....	3	43	6	50
H type, broad.....	.....	.....	5	42

PARIETAL FORAMINA

These are represented quite poorly. In almost half the skulls there are no parietal foramina at all, while in most of the remainder they range from very minute to medium size, of which latter there

¹ The term is used merely for convenience.

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MALE MUNSEE SKULL, NO. 285,308, U.S.N.M. (SIDE VIEW)

is a single instance, and in only one case are there two canals of medium size. The exact significance of this showing is not clearly understood. When present these canals transmit, as is well known, a small arteriole and an emissary vein which connects the venous systems within and without the wall of the skull.

XVII. MUNSEE CRANIA: PARIETAL FORAMINA

	9 males		12 females	
	Cases	Per cent	Cases	Per cent
None.....	3	33	6	50
1 or 2 minute.....	3	33	1	8
1 medium.....	2	22	4	33
2 medium.....	1	11	.....	.....
1 medium on right, 2 minute on left.....	.....	.....	1	8

RETROMASTOID FORAMINA

The retromastoid ("mastoid") foramina are most often two in number—a larger and a smaller—one of which transmits a vein from the transverse sinus within to the cutaneous occipital vein on the outside of the skull wall, and the other a smaller branch of the occipital artery. Like the parietal foramina, they show considerable individual and groupal variation in both number and size. It is not uncommon in some Indian crania to find one of these canals to be of very appreciable diameter (up to 4 mm.). While in the Munsee skulls they appear almost generally two on each side, they are in no instance above moderate size, and in several cases are quite minute. Thus in these specimens the retromastoid foramina stand in harmonious rather than compensatory relation with the small or even absent parietal foramina.

XVIII. MUNSEE CRANIA: RETROMASTOID FORAMINA

	8 males		12 females	
	Cases	Per cent	Cases	Per cent
2, moderate size, each side.....	7	88	5	42
2, small to minute, each side.....	1	12	4	33
1, moderate size, each side.....	.....	.....	1	8
2, small to minute, each side.....	1	12	4	33
2, medium, right side; 2 small, left side.....	.....	.....	1	8

MASTOIDS

The mastoid processes are mainly of importance as sexual characteristics. Their value in this respect, however, differs considerably

from racial group to group, and even within a single stem of people, such as the Indians. On the whole, however, it may be said that in the Indian female the mastoid is somewhat more developed than it is in the average white woman. Occasionally it is considerably more developed, reaching the subaverage or even the average dimensions of that of the males in the same tribe. The grade of development of the process is of course related to the strength and activity of the sternocleido-mastoid muscle, to which it gives attachment. Among the Munsee the size of the mastoids on the whole is only moderate; yet even in this series they rise in one of the female skulls to male-like proportions.

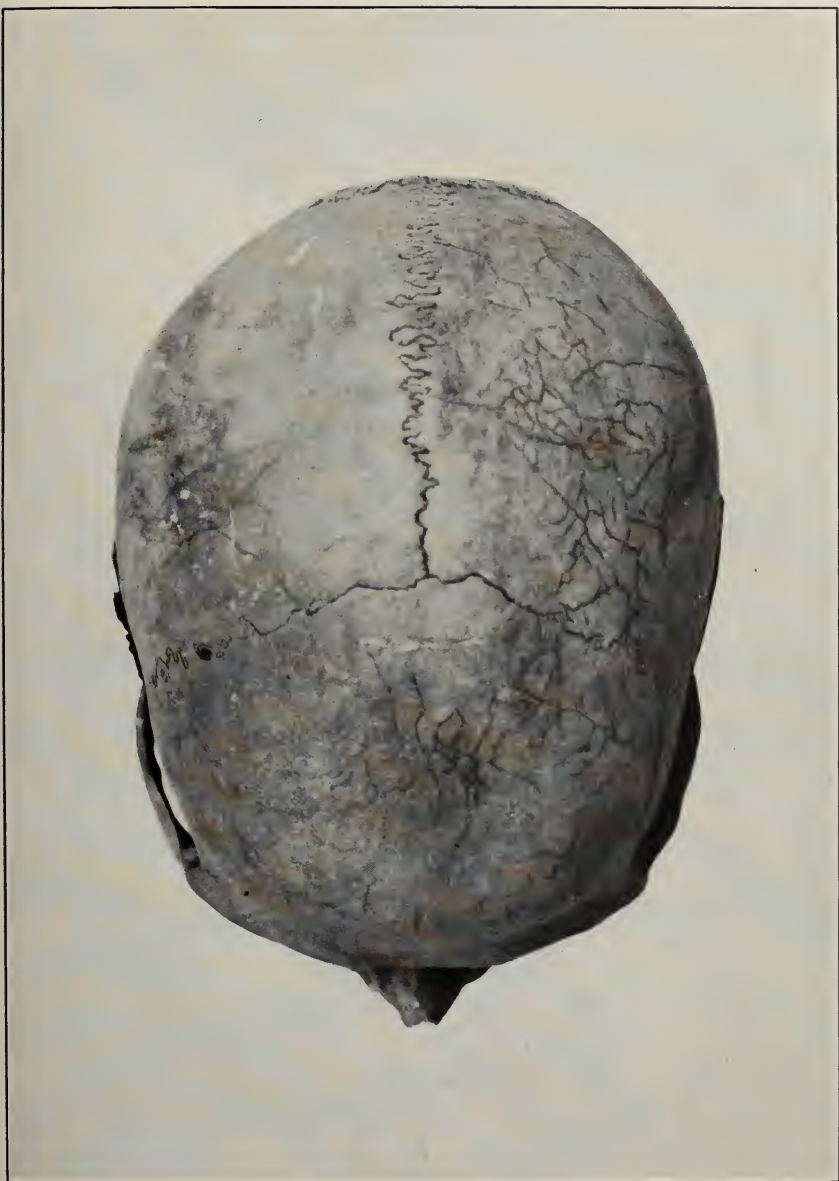
XIX. MUNSEE CRANIA: MASTOIDS

	10 males		12 females	
	Cases	Per cent	Cases	Per cent
Large (masculine).....	1	10	.....	.....
Medium (masculine).....	6	60	1	8
Submedium (feminine).....	3	30	11	92

In one of the females (no. 285,309) the apex of the left mastoid is bifid. Well developed cases of this anomaly are rare; there are only three or four other Indian crania in the large collections of the United States National Museum in which it is well represented. In another female specimen (no. 285,304) the right mastoid shows a peculiar, marked indentation in the middle of its dorsal surface, with a groove extending therefrom upward and backward and downward and backward.

SUPRAORBITAL RIDGES

These ridges, as is well known, are sexual characteristics in the main; phylogenetically they are the remains of the pronounced supraorbital arches of man's anthropoid ancestors and of early man. Like the mastoids they show also considerable individual variation in each sex among the Indians, owing to which they occasionally fail to afford aid in the determination of the sex of the specimen. As a rule they are limited in Indians to the median half to two-thirds of the supraorbital space. In the Munsee skulls at hand they are markedly developed in only one of the males; in two of the male skulls they are small, feminine like, while in two of the female skulls they are so developed as to approximate the supraorbital ridges of the average male.



MALE MUNSEE SKULL, NO. 285,308, U.S.N.M. (VIEW FROM ABOVE)

XX. MUNSEE CRANIA: SUPRAORBITAL RIDGES

	8 males		12 females	
	Cases	Per cent	Cases	Per cent
Pronounced (masculine).....	1	12		
Medium (masculine).....	5	63	2	17
Small (feminine).....	2	25	8	67
Very small.....			2	17

NASION DEPRESSION

The depression at the ridge of the nose is generally well marked in male Indian crania, but is mostly shallow in the female specimens. The depression is never narrow, like a deep line, as in some of the negroes; and in the females it is usually quite wide from above downward. The skulls of the series under consideration show nothing very exceptional in this respect.

XXI. MUNSEE CRANIA: NASION DEPRESSION

	7 males		12 females	
	Cases	Per cent	Cases	Per cent
Pronounced.....	1	14		
Medium.....	5	71	2	17
Shallow.....	1	14	5	42
None or scarcely any.....			5	42

NASAL BRIDGE

The development of the nasal bridge differs among the Indians more or less from tribe to tribe, hence it would be erroneous to assume that all Indians, or even a majority in some of the tribes, had high noses. On the other hand, the nasal bridge is never flat and short as in the negro. In the females, as among the whites, the bridge is generally lower than in the males. The observations on the Munsee, among 17 cases in which the bridge is preserved, show 10 of medium height and 7 submedium to low.

XXII. MUNSEE CRANIA: NASAL BRIDGE

	7 males		10 females	
	Cases	Per cent	Cases	Per cent
Medium height.....	6	86	4	40
Submedium height.....	1	14	2	20
Low.....			4	40

NASAL BONES

The chief feature of the nasal bones to which the student usually directs attention is their breadth. There is on this continent a frequency of especially narrow nasals among the Eskimo. Among the Indians, narrow nasal bones occur only exceptionally; more commonly they are rather broad, though the breadth is not excessive. In the present series we find them fairly broad in all the males and in two of the females; narrow (not excessively) in only two of the females.

XXIII. MUNSEE CRANIA: NASAL BONES

	7 males		12 females	
	Cases	Per cent	Cases	Per cent
Broad.....	7	100	2	17
Medium.....			8	67
Narrow.....			2	17

NASAL APERTURE

The features of chief interest with respect to the nasal aperture are the fulness or sharpness of the inferior borders, the presence or absence of subnasal fossæ or simian gutters, and pronounced asymmetry. Among the 19 Munsee skulls in which these features can be studied, there are only one instance of moderate grooves and three cases of moderate asymmetry. The lower borders are fairly sharp, more so than the average in many other Indians.

XXIV. MUNSEE CRANIA: LOWER BORDERS OF NASAL APERTURE

	7 males		12 females	
	Cases	Per cent	Cases	Per cent
Normal, fairly sharp.....	4	57	11	92
Dull.....				
Asymmetric.....	2	29	1	8
Simian grooves.....	1	14		

NASAL SPINE

On the whole the nasal spine reaches its most pronounced development, especially in height, in the modern whites. It is rudimentary or absent in the anthropoid apes, and seldom reaches marked development in the yellow-brown and black races. Among Indians it ranges from rudimentary or very low to fairly well developed. In the Munsee, as shown by the accompanying figures, it was mostly very low to submedium.



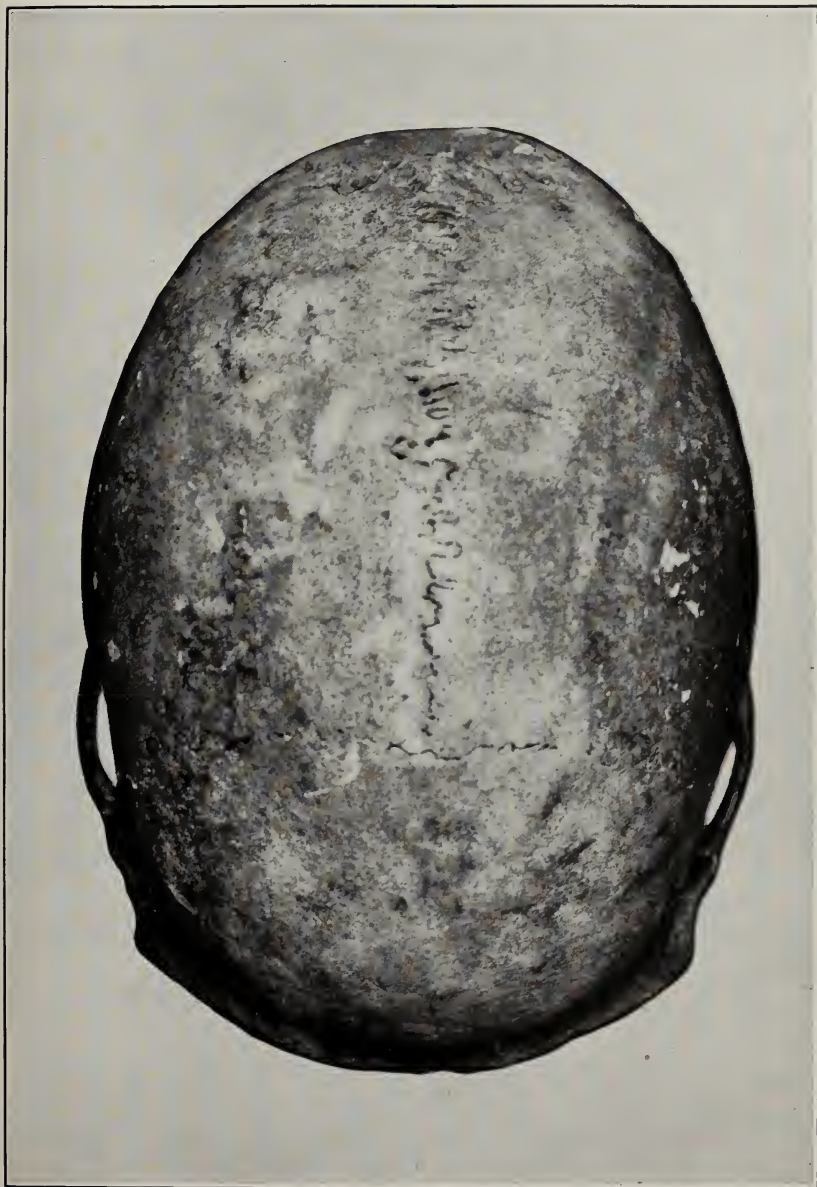
UNDEFORMED TYPICAL FEMALE MUNSEE SKULL, NO. 285,309, U.S.N.M.
(VIEW FROM ABOVE)

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MALE MUNSEE SKULL, NO. 285,306, U.S.N.M., SHOWING FINE OVOID
OUTLINE

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LARGE MALE SKULL, NO. 2010-4423, A.M.N.H., FROM MANHATTAN
ISLAND, SHOWING FINE ELLIPTICAL OUTLINE

XXV. MUNSEE CRANIA: NASAL SPINE

	7 males		11 females	
	Cases	Per cent	Cases	Per cent
About as average in whites.....	1	14	3	27
Submedium.....	4	57	6	55
Very low.....	2	29	2	18

ORBITS

In the majority of skulls under consideration, the orbits offer nothing special morphologically; in a number of instances, however, there is an exceptional conformation, the details of which are shown in the table which follows. The data accentuate the fact, already shown by the measurements, of the considerable range of fluctuation in these features, which, however, seems in this case to have little if any anthropological significance, although it may be due in part to admixture with other people.

XXVI. MUNSEE CRANIA: ORBITS

	7 males		12 females	
	Cases	Per cent	Cases	Per cent
No special features.....	3	43	8	67
Lateral axis of each nearly horizontal.....	1	14		
Lateral axis of each decidedly oblique.....	1	14		
Strikingly large.....			1	8
Strikingly small.....	1	14		
Exceptionally high.....			2	17
Exceptionally low.....	1	14		
Right lower and more oblique than left.....			1	8

SUBORBITAL FOSSÆ

These depressions in the upper maxillæ, which, strictly speaking, have only indirect relation to the canine teeth and do not deserve the old name of "canine fossæ," are generally less well marked or hollowed out in the Indian than in whites, although there is considerable individual variation. In the Munsee, in more than half the skulls, they are shallow to very shallow.

XXVII. MUNSEE CRANIA: SUBORBITAL (CANINE) FOSSÆ

	7 males		12 females	
	Cases	Per cent	Cases	Per cent
Deeply hollowed.....				
Medium.....	3	43	6	50
Shallow.....	3	43	6	50
Only a trace of depression.....	1	14		

These fossæ are of evolutionary significance. In the anthropoid apes they are either entirely wanting or very nearly so, the region being in fact often moderately convex; and the same is true, so far as the evidence is available, of early man to the latter part of the Neanderthal period.

MALAR BONES. ZYGOMÆ

The malars among the Munsee are of moderate development throughout, and none of the bones shows any complete or even appreciable partial division or other anomaly. The zygomatic processes are rather submedium in strength as compared with those of other Indians, particularly in the males.

In one of the male skulls (no. 285,313) the right zygoma is represented only by a pointed but otherwise unaltered base, the rest of the bone, up to the malar suture, being absent. In all probability this condition is the result of an old fracture, after which the larger part of the zygoma was lost or remained separated.

XXVIII. MUNSEE CRANIA: THE MALARS; ZYGOMÆ

MALARS	9 males		11 females		ZYGOMÆ	7 males		11 females	
	Cases	Per cent	Cases	Per cent		Cases	Per cent	Cases	Per cent
Heavy or protruding.					Very broad.....				
Medium development.	9	100	10	91	Medium.....	3	43	10	91
Submedium development.			1	9	Submedium (for the sex and race).	4	57	1	9

UPPER ALVEOLAR ARCH

The main feature for observation of the upper dental arch is its slant or prognathism, and conditions in this respect have already been shown in the main by the measurements. The inspection confirms the fact that in three of the female skulls the arch must be described as markedly slanting. In two cases, in both of which the vault of the skull is artificially deformed, the arch is asymmetric; in one of these, however, the asymmetry is evidently due to early loss of some of the teeth. In no case is there any special massiveness of the arch.

XXIX. MUNSEE CRANIA: UPPER ALVEOLAR ARCH

	8 males		11 females	
	Cases	Per cent	Cases	Per cent
Medium slant.....	8	100	8	72
Marked slant.....			3	27
Asymmetric.....	1	(12)	1	(9)



ADULT MALE SKULL FROM MANHATTAN ISLAND, NO. 99-6667, A.M.N.H.,
SHOWING AN EXCEPTIONALLY HIGH AND NARROW FACE

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LOWER JAW

In 17 of the 20 Munsee skulls in which the lower jaw is present, the latter is of ordinary (Indian) dimensions and form; in one male and in one female it shows strong development. In a single instance only is the chin square; in the others it is moderately rounded. The prominence of the chin in all cases may be described as approximately medium.

XXX. MUNSEE CRANIA: LOWER JAW

	9 males		11 females	
	Cases	Per cent	Cases	Per cent
Ordinary Indian form and moderate development.....	7	78	10	91
Square chin.....	1	11		
Jaw very strong.....	1	11	1	9

PALATE

The shape of the palate is determined by that of the upper dental arch. Of the skulls at hand, in 11 of the 22 cases the outlines of both the arch and the palate are elliptic, in 7 ovoid, and in 4 parabolic. The tendency toward the parabolic form is more marked in the females than in the males. The height of the palate shows nothing exceptional, and there is no torus worthy of notice.

XXXI. MUNSEE CRANIA: PALATE

	10 males		12 females	
	Cases	Per cent	Cases	Per cent
Ovoid.....	3	30	4	33
Elliptic.....	6	60	5	42
Parabolic.....	1	10	3	25
Torus.....				

BASE OF THE SKULL

Glenoid fossæ.—In general the glenoid fossæ of the Indian skulls resemble those among the whites, but there is considerable individual variation, particularly in spaciousness of the hollows. Among the 22 Munsee crania, in 14 the fossæ are of ordinary form and of about medium dimensions; in one they are narrow antero-posteriorly, in 4 wide; in 1 case their axis is decidedly oblique, and in 2 the fossæ differ in depth on the two sides. The wide fossæ are more frequent in the females.

XXXII. MUNSEE CRANIA: GLENOID FOSSÆ

	10 males		12 females	
	Cases	Per cent	Cases	Per cent
Ordinary form and dimensions.....	8	80	6	50
Narrow (antero-posteriorly).....	1	10		
Wide (antero-posteriorly).....	1	10	3	25
Decidedly oblique (laterally).....			1	8
Left shallow, right medium.....			2	17

Floor of auditory meatus.—Among the Indians, and particularly in the young, there are frequently found more or less pronounced defects or dehiscences (Hyrtl) in the floor of the auditory meatus. The frequency of these defects differs from locality to locality and probably from tribe to tribe. They are rather scarce in the Munsee, two-thirds of the crania showing no defect whatever, while of the remainder in only one instance was the perforation large. There seems to be a predominance of this condition in the females.

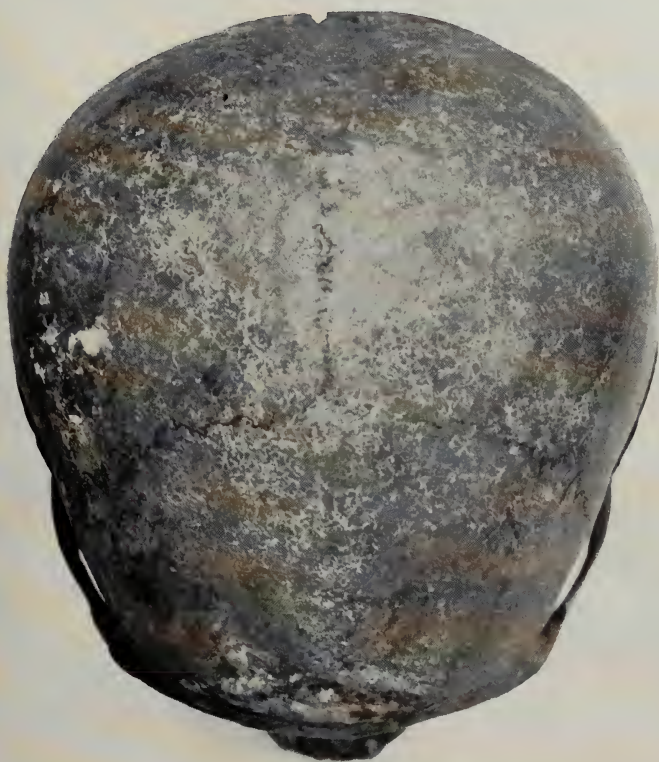
XXXIII. MUNSEE CRANIA: DEFECTS IN FLOOR OF AUDITORY MEATUS

	10 males		12 females	
	Cases	Per cent	Cases	Per cent
None.....	8	80	8	67
Slight, each side.....	1	10	2	17
Moderate, each side.....	1	10	1	8
Large, each side.....			1	8

Styloid processes.—Among the Indians the styloid processes seldom reach good development, although there is some difference in this respect among the tribes. In a great majority of Indian crania the styloid processes are more or less diminutive, and not seldom they are quite rudimentary or even absent, in the latter case usually only small bases being discernible. In the Munsee only four of the twenty-two skulls show styloids which approach the medium or average in whites; in seven the processes are decidedly submedium; and in eleven they are rudimentary.

XXXIV. MUNSEE CRANIA: STYLOID PROCESSES

	10 males		12 females	
	Cases	Per cent	Cases	Per cent
Medium (about average in whites).....	2	20	2	17
Submedium.....	5	50	2	17
Rudimentary.....	3	30	8	67



BRACHYCEPHALIC EXTRANEIOUS FEMALE SKULL, NO. 285,311, U.S.N.M.
(VIEW FROM ABOVE), FOUND WITH THE MUNSEE INDIANS

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SKULL OF MUNSEE CHILD OF ABOUT SIX YEARS OF AGE, NO. 285,329, U.S.N.M., SHOWING

Middle lacerated foramina. Posterior lacerated foramina.—As repeatedly pointed out by the writer on former occasions, the middle lacerated foramina are structures of some importance. They are very small in the anthropoid apes, generally small in negro skulls, submedium to medium in the yellow-brown races and in less developed whites, and reach their maximum spaciousness in civilized modern white men. These differences are connected with the increase in the size of the brain. A growing brain not accompanied with a proportionate or equally rapid increase in the bony structures of the base of the skull (which seems to be most frequently the case) will cause a spreading and bulging of the basal parts, one result of which will be the increased size of the middle lacerated foramina. In the Munsee, in only two of the nineteen skulls in which the basal region is sufficiently well preserved for examination, the foramina about equal in size the average in whites; in nearly half of the remaining skulls they are submedium, and in slightly more than half they are small.

XXXV. MUNSEE CRANIA: MIDDLE LACERATED FORAMINA; POSTERIOR LACERATED FORAMINA

	7 males		12 females			7 males		12 females	
	Cases	Per cent	Cases	Per cent		Cases	Per cent	Cases	Per cent
Medium (about as average in whites)....	1	14	1	8	Of equal size.....	1	14	1	8
Submedium.....	5	71	3	25	Right larger.....	5	71	8	67
Small.....	1	14	8	67	Left larger.....	1	14	3	25

The posterior lacerated or jugular foramina are of interest chiefly because of their frequent and often marked inequality in size, which signifies inequality in the size of the lateral sinuses and especially of the internal jugular veins. The right foramen is frequently larger than the left, a phenomenon which has been associated with the prevailing right-handedness in man. In the nineteen Munsee skulls in which the foramina could be examined, they are of about equal size in only two instances; the right is larger in thirteen, or in two-thirds of the cases, while the left is the larger in only four instances. As the proportion of left-handed persons among the Indians averages only about three per cent, it is evident that in some instances the relation between a larger jugular canal and habitual greater use of the arm of the same side would not maintain; besides, we know the motor centers for the right arm and hand to be on the left side of the brain. Possibly greater blood pressure on the right side in right-handed persons, due directly and mechanically to the

greater muscular activity on that side, would be a more satisfactory explanation.

Depressions of the petrous portions.—In examining the petrous parts in the usual way, with the skull turned base upward, it is observed that in modern men of all races, in the majority of cases, these parts are more or less depressed below the niveau of the surrounding parts. In reality, of course, the surrounding parts have been pressed outward by the developing brain, while the prismatic and resistant petrous parts remained behind. The grade of depression of the petrous parts stands generally in close correlation with the size of the middle lacerated foramina and is of parallel significance.¹ Among the anthropoid apes even a slight depression of the petrous portions is very rare, and most frequently, especially in the orang, these portions rise slightly above the surrounding structures. In the African negro, and occasionally in individual skulls of other inferior races, they are level with the surrounding parts. In better developed negro skulls, as in the majority of those of other primitive peoples, they are slightly to moderately depressed. In white men, and in superior skulls in general, the depression is frequently pronounced, especially, it seems, in the brachycephals. The Indian stands in a practically intermediate position between superior whites and the negroes, and the Munsee are no exception. In two of the skulls the depression is well marked; in three males and seven females it is less than the average in whites; and in two males and five females it is only slight. The females, it will be noted, make a poorer showing in this respect than the males.

XXXVI. MUNSEE CRANIA: DEPRESSION OF PETROUS PORTIONS

	7 males		12 females	
	Cases	Per cent	Cases	Per cent
Medium (about as average in whites).....	2	29	.....	.....
Submedium.....	3	43	7	58
None or almost none.....	2	29	5	42

Pterygo-basal foramina. Posterior condylic foramina.—Interesting features of the base of the skull, to which Gruber and (in this country) Harrison Allen have called attention, are the foramina found occasionally at the base (or proximal part) of the external pterygoid plates. These foramina are seldom complete. They may be single, double, or even triple. They are formed by a process or by processes of bone which proceed upward and backward, and in some cases more or less outward, from the border of the external pterygoid plate. According to the insertion of these processes, the foramina to which

¹ See Hrdlička, Certain Racial Characteristics of the Base of the Skull, *Science*, 1901, p. 309; Proc. Assoc. Amer. Anatomists, 15th Sess., in *Amer. Jour. of Anatomy*, 1, 1901-2, pp. 508-9.

they give rise can be divided into two classes, namely, the more frequent pterygo-spinous and the rarer pterygo-sphenoidal.

Their significance is not yet so clearly understood as is desirable. They are of some anthropological interest and occur quite frequently among Indians, especially in certain localities. Among the Munsee they were rather scarce, particularly in the females.

XXXVII. MUNSEE CRANIA: PTERYGO-BASAL FORAMINA; POSTERIOR CONDYLIC FORAMINA

	7 males		12 females			5 males		12 females	
	Cases	Per cent	Cases	Per cent		Cases	Per cent	Cases	Per cent
None or only a trace..	3	43	11	92	Two, normal.....	3	60	12	100
Pterygo-spinous complete on left, four-fifths on right	1	14	.....	.....	Left absent.....	1	20	.....	.....
Pterygo-spinous incomplete, both sides	1	14	1	8	Right, diminutive...	1	20	.....	.....
Incomplete pterygo-sphenoidal, left side.	1	14	.....	.....			
Complete pterygo-sphenoidal on left (absent on right) ...	1	14	.....	.....			

Posterior condylic foramina.—These are canals which transmit the posterior condylic vein and are of interest only because of their more or less frequent absence from one or both sides in different racial groups. In the Munsee they are exceptionally normal, as will be seen from the preceding figures.

MISCELLANEOUS ANOMALIES

In addition to the peculiarities shown in the preceding paragraphs, the Munsee skulls present a number of anomalous conditions which deserve to be mentioned.

In male skull no. 285,306 the right occipital condyle is flat, the left being normal; there was no injury or arthritis.

In male skull no. 285,326 there is an accessory facet posteriorly to the left condyle.

In female skull no. 285,311 there are two moderate precondylar tubercles.

In male skull no. 285,313 and female skull no. 285,312 there is a moderate medio-basilar ("pharyngeal") fossa.

In female skull no. 285,320 the carotid canals in the petrous parts are usually large, measuring 7 mm. in major diameter.

In female skull no. 285,311 a canal, 6 by 4.5 mm., is present just posteriorly to the right angular process, in the frontal bone and the speno-frontal suture.

Finally, there is a series of anomalies relating to the spinous and oval foramina. They are as follows:

Male skull no. 285,303: The median wall of the left foramina spinosum and ovale is deficient.

Female skull no. 285,310: Median wall of right spinous foramen deficient.

Female skull no. 285,347: Median wall of left spinous foramen deficient.

Female skull no. 285,320: Median wall of each spinous foramen deficient.

Female skull no. 285,323: Right foramina spinosum and ovale connected, and the median wall of both deficient.

Female skull no. 285,311: The left foramen ovale is unusually large, 8.5 by 4.5 mm., while the right is enormous, 10 by 8 mm. (pl. 21).

THE TEETH

Dentition.—Of the 22 skulls of Munsee adults at hand it is possible to ascertain the state of dentition in 14. In 11 of these cases there were 32 teeth in each, while in three there were 31. The congenital deficiency consisted in one case of the third left upper molar; in the second, the third left upper molar is completely absent, while the right corresponding tooth is rudimentary; and in the third there is a congenital absence of the left lower lateral incisor, while on the right side we find the very rare condition of a complete fusion of the lower lateral incisor and the canine (pl. 22).

Loss and decay.—Teeth lost through caries and the presence of decay are common in this series, more so than in other Indian groups. Among the males, 13 per cent of all the teeth were lost in life, while 12 per cent of those still present show more or less decay; among the females 21 per cent were lost in life and 16 per cent of those present show caries—this notwithstanding the fact that the average age of the female skulls was less than that of the males. The teeth lost or affected were mostly the molars, especially those in the lower jaw.

Wear.—In every instance the remaining teeth show more or less pronounced effects of wear. Where the wear is advanced, it is generally also irregular. The detailed notes show that the wear is slight in eight, moderate in five, and advanced in nine of the 22 specimens.

Size, quality, shovel-shaped incisors.—In size the Munsee teeth in all cases are medium. Where not decayed or worn off they show invariably regular and normal development. The upper incisors present in every case the cingulum which gives their lingual surface a more or less pronounced shovel-shaped character, common to and characteristic of all Indians, with rare individual exceptions.



BASE OF FEMALE SKULL NO. 285,311, U.S.N.M. (BRACHYCEPHALIC EXTRANEUS), FOUND AMONG THE MUNSEE BURIALS, SHOWING EXCESSIVE SIZE OF THE FORAMINA OVALE, ESPECIALLY ON THE RIGHT SIDE

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LOWER JAW OF FEMALE MUNSEE SKULL NO. 285,307, U.S.N.M., SHOWING COMPLETE FUSION
OF THE RIGHT LOWER LATERAL INCISOR AND CANINE

Anomalies.—The anomalies of the teeth are always of considerable interest, being mainly either reversive or degenerative (progressively) in character. The skulls observed indicate the following conditions:

Male no. 285,301: A small supernumerary tooth between and on the labial side of the left lower second and third molars. The lateral upper incisors in this skull are somewhat abnormal lingually, their surface appearing as if rolled together from side to side, so that the tooth is cylindrical in form and its shovel-like hollow has become almost a cavity.

In male no. 285,303: The third right upper molar is diminutive.

In male no. 285,305: The third lower right molar is impacted, its vertical axis tending forward and upward.

In male no. 285,326: The third right upper molar is diminutive.

In female no. 285,305 is present the aforementioned fusion of the right lower lateral incisor and canine. The resultant tooth appears like a broad stout incisor (pl. 22).

In female no. 285,310: The crown of the right lower third molar is unusually large (13.5 mm. long by 12 mm. broad) and looks like that of a fused double tooth, but both first and second molars are present. The opposite tooth is also larger than ordinary, but the upper corresponding teeth are normal.

Finally, in no. 285,311 the third right upper molar is rudimentary.

Cuspids.—Many of the molars present were so worn that a determination of their cuspid formulæ was impossible. The better preserved teeth showed the interesting conditions detailed in the following table:

XXXVIII. MUNSEE CRANIA: MOLARS; CUSPIDARY FORMULÆ

UPPER MOLARS

MALES

First molar			Second molar			Third molar		
Cusps	Number of teeth examined	Per cent	Cusps	Number of teeth examined	Per cent	Cusps	Number of teeth examined	Per cent
4	15	100	4	4	30	3 2/2	1	11
			* 3 1/2	7	54	2 2/2	3	33
			3	1	8	2 1/2	1	11
			2 3/2	1	8	† Pursed	4	44

* 1/2=one small cusp; 2/2=two small (or half) cusps, etc.

† Appearing like the mouth of a tightly drawn tobacco-pouch or purse.

XXXVIII. MUNSEE CRANIA: MOLARS; CUSPIDARY FORMULÆ—Continued

UPPER MOLARS—Continued

FEMALES

First molar			Second molar			Third molar		
Cusps	Number of teeth examined	Per cent	Cusps	Number of teeth examined	Per cent	Cusps	Number of teeth examined	Per cent
4	14	100	3 1/2	13	100	3	2	15
						2 3/2	1	8
						2 2/2	1	8
						Pursed	9	69

LOWER MOLARS

MALES

5	4	100	5	1	33	5	2	50
			4 1/2	1	33	4 2/2	1	25
			4	1	33	4	1	25

FEMALES

5	1	100	4 1/2	2	67	4	4	67
			4	1	33	Pursed	2	33

It will be observed that the 29 first upper molars have all four regular cusps, while all the first lower molars have five. The second upper molars vary in the males, but show all three ordinary and one small cusp (the posterior lingual) in the females. The wisdom teeth fluctuate considerably in both sexes, both as to size and to form.

SUMMARY OF MEASUREMENTS AND OBSERVATIONS ON THE CRANIA

A summary of the results of the examination and measurements of the Munsee skulls includes the following points of interest:

A number of the specimens show traces of intentional fronto-occipital deformation, which is completely absent among other Indian tribes of the northeastern and Middle Atlantic States; and several of the skulls are of distinctly extraneous type. Both of these conditions point to admixture, which in all probability came from the southwestward and may have been due to Shawnee influence during the last few decades of the occupancy by the Munsee of the upper Delaware.

The crania that can be safely accepted as belonging to the Munsee themselves, and which are not deformed, are characterized by moderate dolichocephaly to mesocephaly and a high vault. They are not thick-walled and show fair capacity.

The face is of moderate dimensions and lacks prognathism. The facial index ranges from mild chamæprosopy to mild leptoprosopy.

The orbits are very variable, but the majority are mesoseme.

The nose is rather short, but fairly broad; the average index is mesorhinic.

The palate is of only moderate length, but fairly broad; its index in both sexes is brachyuranic.

The lower jaw is of moderate dimensions throughout.

The teeth are medium in size.

Descriptive features.—The forehead is chiefly of medium development in the males, in the females frequently somewhat low.

The sagittal region shows more or less arching, in no case extreme; the temporo-parietal region and the occiput present mostly medium forms.

Serration of cranial sutures is submedium to very submedium. Wormian and other intercalated bones are scarce. The order of occlusion of sutures among the males was S-C-TO-L; among the females TO-S-C-L (see page 35).

The pterions are all of the H type, with tendency to narrow in males, medium to broad in females.

Parietal foramina are few in number and small, retromastoid foramina moderate to small.

The mastoid processes and the supraorbital ridges present ordinary development and variation; no excess.

The nasion depression is well marked in the males, mostly shallow in the females; nasal bridge is medium to submedium, nasal bones of fair breadth; lower borders of the nasal aperture are mostly fairly sharp, and with one exception there are no simian grooves or subnasal fossæ; nasal spine ranges from very low to submedium.

The orbits show exceptional variation in form, as they do in measurements; suborbital (canine) fossæ are shallow to medium; malar bones are of but moderate development, without anomalies; zygomæ average somewhat submedium as compared with those of other Indians.

The upper alveolar arch is mostly of very moderate slant and free from abnormalities. The lower jaw is of ordinary form, without anomalies. The palate in half the cases is elliptic, in two-thirds of the remainder ovoid, and in one-third parabolic; it is in no case exceptionally low or very high, and there is no torus.

Base.—The glenoid fossæ in a majority of the crania show usual form and medium dimensions, but tend to widenness in a number of the females; dehiscences in the floor of the auditory meatus are, for Indians, scarce.

The styloid processes reach medium development in but few instances, and they are frequently rudimentary.

The middle lacerated foramina are mostly submedium to small; depression of petrous portions prevalently submedium to slight. The posterior lacerated or jugular foramina are, as usual, in a majority of the cases larger on the right side. Pterygo-basal foramina are scarce.

Anomalies observed on the skulls pertain mostly to the basal structures, particularly the condyles and the sphenoidal foramina.

Teeth.—Dentition was remarkably regular, but decay and loss of teeth in life were relatively more frequent than in other Indians; upper incisors, especially the middle, are shovel-shaped lingually, as usual in Indians. More or less wear of the teeth in the adults is present in every instance. Dental anomalies, while few in number, comprise a case of special interest: a perfect fusion of canine and incisor.

THE BONES

By reason of the care with which the bones were collected from the Minisink cemetery, those of the different adult skeletons were kept apart as found and are thus perfectly identifiable as to individuals. Excluding those of adolescents and children, there are present the bones of 32 adult skeletons, and in the majority of cases these are almost complete. Of these 32 individuals, 17 were male and 15 female, thus affording a fair series for comparison.

The bones in general are practically normal and almost free from important anomalies. They indicate people of medium to somewhat above medium stature, and of good though not excessive muscular development. In their morphological features they approximate in many respects the bones of whites, yet differ in numerous interesting particulars.

Although a number of the subjects represented by the skeletal remains were old people, there is an absence of light bones or of other evidences of senility. The proportion of such bones in modern whites is in fact much larger than among any of the Indians, either prehistoric or modern, a fact of considerable physiological importance.

HUMERUS

GENERAL OBSERVATIONS

There are present 46 adult humeri, mostly perfect and almost all paired. The principal measurements of these are given in the following table:

XXXIX. MUNSEE: HUMERI

MALES

Right					Left				
Number of adult humeri	Length, maximum	Diameters at middle*		Index of shaft (b×100) a	Number of adult humeri	Length, maximum	Diameters at middle*		Index of shaft (b×100) a
		Major (a)	Minor (b)				Major (a)	Minor (b)	
Average:	cm.	cm.	cm.		Average:	cm.	cm.	cm.	
Paired (13)...	32.5	2.24	1.65	73.6	Paired (13)...	32.6	2.2	1.64	74.6
Total present (14).....	32.5	2.25	1.65	73.4	Total present (13)...	32.6	2.2	1.64	74.6
Minimum:					Minimum:				
Total present (14).....	31.1	1.9	1.5	65.2	Total present (13)...	31.-	1.85	1.4	65.2
Maximum:					Maximum:				
Total present (14).....	34.4	2.6	1.85	81.6	Total present (13)...	34.7	2.55	1.95	81.4

FEMALES

Average:					Average:				
Paired (12)...	30.6	2.09	1.43	68.4	Paired (12)...	30.2	2.01	1.4	69.8
Total present (15).....	30.7	2.08	1.41	67.7	Total present (12)...	30.2	2.01	1.4	69.8
Minimum:					Minimum:				
Total present (15).....	28.5	1.9	1.2	61.9	Total present (12)...	28.5	1.75	1.25	63.6
Maximum:					Maximum:				
Total present (15).....	32.3	2.3	1.7	77.3	Total present (12)...	31.9	2.2	1.7	77.3

* Diameter major=parallel to the flat anterior surface; diameter minor—at a right angle to the preceding.

The averages are in no way exceptional. Reference to the writer's report on the Indian skeletal remains from Arkansas and Louisiana¹ will show that the humeri of that collection had practically the same dimensions.

The relation of the average of paired female humeri to that of paired male humeri is as 94.2 to 100, which is somewhat higher than existed among the Arkansas and Louisiana Indians (91.34 for 86 humeri), among Indians in general (91.2 for 602 humeri), and also among whites (91.8 for 2,700 humeri), but is lower than in the American negro (94.6 for 164 humeri). As no error in the sexual identification entered into the present series, the disparity here shown is difficult to explain, except perhaps by the result of some peculiar local occupational differences in the two sexes or a local hereditary multiplication of an individual peculiarity.

¹ *Jour. Acad. Nat. Sci. Phila.*, XIV, 1909, pp. 211-212.

The right and left humeri are of practically the same length in the males, while in the females the average of the left bones is slightly inferior to that of the right, as is usual in most Indian tribes and also among the white and other races. The equal length of the arm bones in the males indicates probably a lack of specialized occupation.

The dimensions of the shaft of the humerus at the middle and their percental relation or index are interesting in several respects, as shown by the following data:

XL. COMPARISON IN DIMENSIONS OF MUNSEE WITH OTHER RACIAL HUMERI

	Males				Females			
	Whites	American negroes	Munsee	Other Indians	Whites	American negroes	Munsee	Other Indians
Number of humeri (both sides).....	(1,930)	(112)	(26)	(348)	(770)	(52)	(24)	(254)
Length, cm.....	32.53	32.7	32.55	31.67	29.8	30.9	30.4	28.9
Mean diameter of shaft at middle, cm.....	2.02	2.09	1.93	1.91	1.83	1.89	1.78	1.69
Index of shaft.....	83	84.1	74.1	73.1	79.3	79.2	69.1	70.3

In the first place it will be seen that although the Munsee arm bones are practically of the same average length as those of the miscellaneous American whites, their strength in both sexes, and especially in the males, is greater in the whites. It will further be noted that the disproportion is especially pronounced in the thickness of the bone, the humerus of whites, both male and female, being the stouter, as a result of which the shaft index is decidedly higher in the whites than in the Indians—the Munsee humerus, in other words, is more platybrachic. Much the same distinction exists between the Munsee humeri and those of the American negro; while on the other hand it will be noted that in this respect there is close harmony between the Munsee and other Indians.

Referring again to the table on page 53, and contrasting the bones of the two sides, it will be observed that the left humerus in both sexes is on the average weaker, though the difference is quite small; also that the shaft index in both sexes is larger on the left side. Exactly the same conditions have been observed by the writer on the several series of arm bones of whites and negroes, and also on other Indians, as are presented in preceding tables, which fact shows that we are dealing with no accidental phenomena. The difference in the index between the two sides is due exclusively to the relatively greater breadth (i. e., the antero-posterior diameter) of the right bone, the thickness of the humerus being very nearly the same on the two sides of the body.



SUPRACONDYLOID PROCESS IN A FEMUR, AND A SPURIOUS SUPRACONDYLOID FORAMEN IN A HUMERUS OF THE MUNSEE

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DETAILED OBSERVATIONS

Shape of the shaft.—A number of years ago the writer¹ called attention to the fact that in transverse sections at the middle the long-bones show each a considerable variety in the shape of the shaft, and that these varieties can be reduced for each bone to several distinct types of both functional and racial significance. As to the humeri, the most frequent shapes are the p. c., plano-convex or infantile form; type 1, or ordinary prismatic; type 2, lateral prismatic; and type 4, in which the anterior border is broadened out to a distinct fourth surface.

Among the Munsee the occurrence of shapes was as follows:

XLI. MUNSEE HUMERI: SHAPE OF SHAFT

Type	Male				Female			
	Right		Left		Right		Left	
	Speci- mens	Per cent	Speci- mens	Per cent	Speci- mens	Per cent	Speci- mens	Per cent
pc—plano-convex.....	3	21	2	15	2	13.3	3	23
1—ordinary prismatic or near	6	43	6	46	9	60	5	39
2—lateral prismatic.....	1	7	2	15	.....	.....	.....	.....
4—quadrilateral.....	2	14	.....	.....	2	13.3	3	23
Various intermediate.....	2	14	3	23	2	13.3	2	15

The most frequent shape is the ordinary prismatic; the next in frequency is the plano-convex; the lateral prismatic is the least common. The significance of these conditions must be left for future consideration, when our data, especially on the American Indians, are more extensive.

Perforation of the septum.—The septum between the olecranon and coronoid fossæ in Indians often shows a smaller or a larger perforation. The frequency of this developmental anomaly or condition differs from tribe to tribe, and it differs also between the sexes, being as a rule more common in females. In the Munsee male humeri only six instances of such perforation exist, three in right and three in left bones, the total amounting to 22 per cent of the bones. In only one instance is the opening large; in three it is medium; in one small, and in one of pin-point size. In the 29 female humeri which could be examined for this feature the conditions are quite different, the perforation being present in no fewer than 17 cases, or nearly 59 per cent of the bones. Eight of the 17 are right (47 per cent), nine left (53 per cent). As to size of the perforation, one is pin-point, eight small, and eight medium; none is large.

¹ Hrdlička, Typical Forms of Shaft of Long Bones, *Proceedings of the Association of American Anatomists*, 14th Sess., Dec. 1900, pp. 55-60, figs. 1-2, Washington, 1901.

Supracondyloid process.—This process, which in a more or less rudimentary form, and especially in the form of a ridge, is not rare in whites, is very uncommon in the Indians, though even in this race in the majority of humeri some roughness, or even a slight ridge, can be detected in its position. Among the Munsee humeri no specimen shows more than a trace of the anomaly.

The rarity of this process in the Indian is of additional interest from the fact that it seems to be shared by other branches of the yellow-brown race, and also by the blacks; moreover, the process appears to be absent, or nearly so, in the humeri of all known apes. The problem as to why a feature of this nature, which appears clearly to be reversive, should be more common in modern whites than in the more primitive races and even in the anthropoid apes and the lower primates, offers a fruitful field for investigation.

RADIUS

The total number of radii in condition to be measured is 41, 19 male and 22 female. Taking the paired bones in the males, we find that their length is equal on the two sides, as was very nearly the case with the humeri; in the females the right radius averages slightly longer than the left, again as in the arm bones of this sex. The arms as a whole were therefore of very nearly the same length on the two sides in the males, but the right was generally slightly longer than the left in the females, a condition which in all probability was connected with the relatively greater use of the right hand and arm in the latter sex.

The percental relation between the length of the radius and that of the humerus approximates 79 on both sides in the males and 78 in the females. Indians of other localities show much the same condition, the index approximating in the males 78 on both sides and in the females 77 on both sides. In whites the same index is only 73.6 in the males and 72.8 in the females; while the American negro gave to the writer 77.4 for the male and 76.8 for the female sex. This means that the forearm in the Munsee and in Indians generally is relatively long; it is decidedly longer in relation to the humerus than in the whites, and so far as the Munsee are concerned it is even slightly longer than in the average American negro; and in all the groups it is to a slight extent relatively longer in the males than in the females.

In strength, curvature, and other features the Munsee radii show nothing exceptional. In fact, this bone is of secondary importance in the anthropology of modern races except in its relative proportions.

XLII. MUNSEE: RADIUS

MALES

Number of bones	Right			Left			
	Length, maximum	Number of cases	Radio-humeral index $\frac{R \times 100}{H}$	Number of bones	Length, maximum	Number of cases	Radio-humeral index $\frac{R \times 100}{H}$
Average:	<i>cm.</i>				<i>cm.</i>		
Paired (9).....	25.7	(8)	78.8	(9)	25.7	(8)	78.8
Total present (11).....	25.65	(10)	78.9	(9)	25.7	(8)	78.8
Minimum, total present (11).....	24.6	(10)	74.9	(9)	24.6	(8)	76.1
Maximum, total present (11).....	26.6	(10)	82.5	(9)	26.4	(8)	82.1

FEMALES

Average:							
Paired (10).....	23.7	(10)	77.5	(10)	23.45	(10)	78
Total present (11).....	23.66	(10)	77.5	(12)	23.54	(11)	78
Minimum, total present (11).....	22	(10)	74.8	(12)	21.6	(11)	74.7
Maximum, total present (11).....	24.7	(10)	80.1	(12)	24.6	(11)	80.1

ULNA

Like the radius, the Munsee ulna shows nothing specially noteworthy as regards its form. The curvature is moderate, as a rule, and so is the strength of the bone. The dimensions are presented in table XLIII.

As with the other two long-bones of the upper limb, the length of the ulna is practically the same on the two sides in the males, and slightly shorter on the left than on the right in the females.

XLIII. MUNSEE: ULNA

	Males				Females			
	Right		Left		Right		Left	
	Number of bones	Length, maximum	Number of bones	Length, maximum	Number of bones	Length, maximum	Number of bones	Length, maximum
Average:		<i>cm.</i>		<i>cm.</i>		<i>cm.</i>		<i>cm.</i>
Paired.....	6	27.6	6	27.5	10	25.5	10	25.2
Total present.....	8	27.5	9	27.7	11	25.45	11	25.3
Minimum.....	8	26.6	9	26.1	11	23.7	11	23.4
Maximum.....	8	28.6	9	29.3	11	26.5	11	26.5

FEMUR

GENERAL OBSERVATIONS

The total number of adult femora in condition for measurement is 60—33 males, 27 females.

The bones, as a rule, are normally developed and with one exception free from anomalies. The exception is the left femur of male subject no. 285,301, which shows a large spinous process on the mesial border of the bone above the internal condyle (*proc. supracondyloideus femoris*), as exhibited in plate 23. The linea-aspera, while mostly well developed, is in no case exceptionally high. The curvature and torsion show nothing exceptional.

MEASUREMENTS

As this is the most important of the long-bones, a number of measurements besides the length were taken, as indicated below.

The mean bicondylar length of the Munsee femora, taking both sides together, is 45.5 cm. in the males and 42 cm. in the females. Judging from observations on whites and on other Indians, these lengths correspond to the average stature of approximately 167 cm. in the male and 156 cm. in the female Munsee. These figures are very close to those obtained by the help of the well-known Manouvrier and Rochet tables, and may therefore be safely accepted. They show that the Munsee were somewhat above the medium, but not really tall in stature.

XLIV. MUNSEE: FEMORA

MALES

	Right												
	Number of bones	Length bicondylar	Length maximum	Number of cases	Humero-Femoral Index $\frac{H \times 100}{F}$	Number of cases	Diameter antero-posterior at middle* (a)	Diameter lateral at middle† (b)	Index of shaft $\frac{b \times 100}{a}$	Number of cases	Diameters at upper flattening		Platymeric index $\frac{d \times 100}{c}$
											Maximum (c)	Minimum (d)	
Average:		cm.	cm.				cm.	cm.			cm.	cm.	
Paired.....	12	45.2	45.8	8	71.8	16	2.92	2.55	87.1	15	3.23	2.37	73.3
Total present...	14	45.26	45.8	11	72.1	17	2.91	2.53	87.1	17	3.22	2.35	73.1
Minimum.....	14	43.4	43.8	11	69.6	17	2.5	2.2	73.5	17	2.9	2	64.6
Maximum.....	14	48.1	48.7	11	76.3	17	3.3	2.95	100	17	3.75	2.7	90
	Left												
	Number of bones	Length bicondylar	Length maximum	Number of cases	Humero-Femoral Index $\frac{H \times 100}{F}$	Number of cases	Diameter antero-posterior at middle* (a)	Diameter lateral at middle† (b)	Index of shaft $\frac{b \times 100}{a}$	Number of cases	Maximum (c)	Minimum (d)	Platymeric index $\frac{d \times 100}{c}$
Average:		cm.	cm.				cm.	cm.			cm.	cm.	
Paired.....	12	45.4	45.9	8	71.7	16	2.9	2.61	89.9	15	3.33	2.38	71.6
Total present...	15	45.82	46.3	9	71.3	16	2.5	2.25	75	15	2.9	2.1	59.5
Minimum.....	15	43.7	44	9	67.7	16	2.5	2.25	75	15	2.9	2.1	59.5
Maximum.....	15	49.2	50	9	75.7	16	3.3	2.9	107.7	15	3.7	2.7	93.7

* Maximum.

† Linea aspera midway between the two branches of the compass.



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XLIV. MUNSEE: FEMORA—Continued

FEMALES

	Right												
	Number of bones	Length bicondylar	Length maximum	Number of cases	Humero-Femoral Index $\frac{H \times 100}{F}$	Number of cases	Diameter antero-posterior at middle * (a)	Diameter lateral at middle† (b)	Index of shaft $\frac{b \times 100}{a}$	Number of cases	Diameters at upper flattening		Platymetric Index $\frac{d \times 100}{c}$
											Maximum (c)	Minimum (d)	
Average:		cm.	cm.				cm.	cm.			cm.	cm.	
Paired.....	13	42.1	42.65	10	72.6	13	2.58	2.35	91.2	12	2.88	2.17	75.5
Total present..	14	.....	.....	12	72.7	14	2.56	2.37	91.6	14	2.89	2.14	74
Minimum.....	14	39.4	40	12	70.6	14	2.3	2	82.1	14	2.5	1.85	56.9
Maximum.....	14	44.7	45.1	12	74.4	14	2.95	2.6	106.2	14	3.25	2.45	84.5
	Left												
	Number of bones	Length bicondylar	Length maximum	Number of cases	Humero-Femoral Index $\frac{H \times 100}{F}$	Number of cases	Diameter antero-posterior at middle * (a)	Diameter lateral at middle† (b)	Index of shaft $\frac{b \times 100}{a}$	Number of cases	Diameters at upper flattening		Platymetric Index $\frac{d \times 100}{c}$
											Maximum (c)	Minimum (d)	
Average:		cm.	cm.				cm.	cm.			cm.	cm.	
Paired.....	13	41.9	42.6	10	71.65	13	2.48	2.38	93.1	12	3.03	2.17	71.7
Total present..	13	.....	.....	10	.....	13	.....	.....	.....	12	.....	.....	.....
Minimum.....	13	39.6	40	10	69.4	13	2.25	2	83.3	12	2.6	1.8	56.1
Maximum.....	13	44.5	45.4	10	73.2	13	3	2.65	113	12	3.35	2.45	87.7

* Maximum.

† Linea aspera midway between the two branches of the compass.

The two lengths of the femur, the bicondylar and the maximum, differ somewhat as a rule in favor of the latter. The difference is true and proportional to the inclination of the axis of the shaft and the development of the internal condyle, and ranges in different individuals from 0.5 mm. to 15 mm. In whites in all the groups studied it is moderate, not reaching 4 mm. in the average. In the American negro (who often has some white blood), the disproportion between the two lengths is slightly higher than in the whites, but additional observations are needed. Among Indians, however, the difference is perceptibly higher than among the whites, and is especially pronounced among the Munsee, where it reaches the average of early 5 mm. in the males (taking the mean of the two sides) and 4 mm. in the females. As the Munsee bones are perfectly normal, the explanation of this peculiarity must be sought either in an unusual breadth of the pelvis or in a somewhat greater length of the neck of the femur, and may be connected with some functional characteristic of these people, such as possibly a more than usual prevalence of the habit of squatting.

XLV. MUNSEE AND OTHER FEMORA: RELATIONS BETWEEN THE BICONDYLAR
AND MAXIMUM LENGTH OF THE BONES

	Munsee		Other Indians		United States whites		Italians		American negro	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Number of paired bones.....	12	12	55	22	100	50	31	8	12	8
Average excess of the maximum over the bicondylar length:										
Right, cm.....	5.35	5.6	4	3.8	3.05	3.78	3	2.6	4	3.2
Left, cm.....	4.2	6.45	4.2	3.2	2.55	3.8	2.58	2.1	3.25	3.5

The difference between the maximum and bicondylar length of the femur in some racial groups averages greater in the females than in the males, while in others the condition is reversed. Among the Munsee the females show the greater difference (6 mm. to slightly less than 5 mm. in the males); but this peculiarity is not shared by other Indian groups. A condition similar to that of the Munsee exists in this respect among the United States whites, where the difference between the two lengths averages 3.8 mm. in the females and only 2.8 mm. in the males; while among the Italians, and to a less extent the negroes, the disproportion is greater in the males (Italians: m. 2.8, f. 2.35 mm; negroes: m. 3.6, f. 3.35 mm.). The excess of the difference in males in these groups was unexpected, the usual impression being that the axis of the female femur is generally more oblique than that of the male; and the more oblique the axis, the greater should be the difference between the bicondylar and maximum length of the bone.

As to the two sides of the body, in the majority of the groups whose femora were studied, greater average differences were found between the two lengths of the bone on the right than on the left; in a few groups, however, such as the Munsee, the United States whites, and the United States negro females, the condition was reversed.

These interesting conditions and exceptions make it probable that an extended special study of the relations of the two femoral lengths would be well repaid by the results.

The relation in bicondylar length of the Munsee female to the male femora is as 92.7 to 100, and practically the same result was obtained in other Indians (92.65 to 100). In United States whites the proportion is as 93 to 100; in American negroes, as 93.1 to 100. These are striking similarities in people so far apart racially.

HUMERO-FEMORAL INDEX

The percental relation in length of the femur to the humerus in the Munsee, the humero-femoral index ($\frac{\text{maximum length of humerus} \times 100}{\text{bicondylar length of femur}}$), approximates in both sexes 72, which is very near the average in human races generally. The similarity of this important relation in different racial groups, as may be seen from the measurements by the writer in the next table, is quite remarkable.

As a rule the humero-femoral index is in both sexes slightly higher on the right than on the left side, and the Munsee form no exception in this particular. As to sex, while in all branches of the whites, as well as in the United States negroes, the male index on both sides is slightly higher, in the Munsee, as well as in other Indians, the index in the male is slightly lower than that in the female. These features are all connected, of course, with the peculiarities of the length of the Indian humerus as well as the femur, outlined in other chapters.

CLVI. HUMERO-FEMORAL INDEX IN THE MUNSEE AND IN OTHER RACIAL GROUPS

	Male			Female		
	Subjects	Right	Left	Subjects	Right	Left
Munsee.....	8	71.8	71.7	10	72.6	71.7
Other Indians.....	100	72.3	71.6	61	72.7	71.8
United States whites.....	200	72.2	71.7	63	71.8	70.9
Irish.....	22	72.6	71.9	35	71.7	70.6
Germanians.....	86	72.8	72	21	72.4	71.3
Italians.....	39	72.5	72.3	11	72.6	72
Other whites.....	53	73.9	73	15	72.9	71.3
United States negroes.....	25	71.7	71.5	13	70.3	70.2

THE SHAFT

The measurements taken at the middle of the shaft in the Munsee femora indicate generally a moderate development. The mean diameter is smaller in both sexes than it is in ordinary American whites and negroes¹ of the same stature. The same condition, though in a somewhat lesser degree, was observable in the Arkansas and Louisiana Indian femora, and there are reasons to believe that it is common to other Indian tribes, if not general in the race. The whites and negroes used here for comparison are of course those of the working classes, or such as find their way into dissecting rooms.

As to the strength of the femur on the two sides of the body, the difference in the Munsee, as well as in other Indians and racial groups, is very small. However, in the males a slightly higher average mean diameter is seen in the left femur, while in the females the

¹ Males: Munsee, 2.74; United States whites, 2.9; United States negroes, 2.91 cm.
Females: Munsee, 2.54; United States whites, 2.69; United States negroes, 2.6 cm.

condition is reversed. Curiously the same slight excess in strength of the left femur in the male and of the right in the female is exhibited also by the United States whites, while in the United States negroes, in both sexes, the bones of the two sides are exactly equal, as is shown in the following table:

XLVII. STRENGTH OF THE FEMUR ON THE TWO SIDES OF THE BODY

MEAN DIAMETER AT THE MIDDLE OF THE SHAFT

	Munsee	United States whites	United States negroes
Male:	<i>cm.</i>	<i>cm.</i>	<i>cm.</i>
Right.....	2.73	2.89	2.91
Left.....	2.75	2.91	2.91
Female:			
Right.....	2.46	2.74	2.60
Left.....	2.43	2.64	2.60

Taking the antero-posterior and lateral diameters at the middle of the shaft separately, we find several more interesting points. The antero-posterior diameter in the Munsee (and the same is true of the United States whites and United States negroes, as will be seen by the following table) is practically equivalent in the right and left femora in the males; but except in the whites it is perceptibly smaller on the left side in the females of all groups. On the other hand, the lateral diameter, excepting in the probably too small male negro series, is invariably larger on the left than on the right side in both males and females. Thus it may be said that the left femur is almost invariably slightly broader on the average than the right, and this especially in the females of probably all racial groups.

These interesting conditions are most clearly shown by the shaft index ($\frac{\text{diameter lateral} \times 100}{\text{diameter antero-posterior}}$), which in both sexes and in all the racial subdivisions is higher on the left side.

The index in the Munsee femora is noteworthy in another respect. It is decidedly smaller in both sexes of this group than it is in the American negro and especially in the United States whites. Judging from data on other Indians in the writer's possession, it seems very probable that the characteristic shown by the Munsee in this regard is common to Indians in general. As may be seen by reference to the figures in the following table, the low shaft index in the Munsee is due entirely to smaller breadth; the Munsee femur is relatively narrower than that of both whites and negroes.

XLVIII. COMPARISON OF THE PROPORTIONS AND INDEX OF THE SHAFT OF THE

FEMUR AT MIDDLE, IN MUNSEE, WHITES, AND NEGROES. PAIRED BONES

MALES						
	Right			Left		
	Diameter antero-posterior	Diameter lateral	Index	Diameter antero-posterior	Diameter lateral	Index
Munsee:	<i>cm.</i>	<i>cm.</i>		<i>cm.</i>	<i>cm.</i>	
Specimens.....	(16)	(16)	(16)	(16)	(16)	(16)
Average.....	2.92	2.55	87.1	2.90	2.61	89.9
United States whites:						
Specimens.....	(66)	(66)	(66)	(66)	(66)	(66)
Average.....	2.95	2.84	96.3	2.95	2.87	97.4
United States negroes:						
Specimens.....	(6)	(6)	(6)	(6)	(6)	(6)
Average.....	3.06	2.77	90.5	3.06	2.77	90.5
FEMALES						
Munsee:						
Specimens.....	(13)	(13)	(13)	(13)	(13)	(13)
Average.....	2.58	2.35	91.2	2.48	2.38	93.1
United States whites:						
Specimens.....	(28)	(28)	(28)	(28)	(28)	(28)
Average.....	2.64	2.58	97.7	2.65	2.63	99.5
United States negroes:						
Specimens.....	(7)	(7)	(7)	(7)	(7)	(7)
Average.....	2.68	2.53	94.4	2.63	2.58	98.1

PLATYMERY

Another anthropologically important region of the femur is the subtrochanteric flattening, which, as well known, has been studied in whites and in other races by Manouvrier and other observers.¹ The flattening in question is situated below the minor trochanter, reaching its maximum at approximately 3 cm. below that point. It yields itself to two measurements, the maximum and the minimum diameter, and the percental relation of the latter to the former constitutes the platymeric index. This index is generally quite high in whites, in whom the flattening is but moderate.

The next table shows the conditions found in this respect with regard to the Munsee, the United States whites, and the United States negroes.

¹ See Hrdlička, Report on Additional Skeletal Remains from Arkansas and Louisiana, *Jour. Acad. Nat. Sci. Phila.*, xiv, 1909, pp. 215-216.

XLIX. COMPARISON OF THE PROPORTIONS AND INDEX OF THE SHAFT OF THE FEMUR AT THE SUBTROCHANTERIC FLATTENING, IN THE MUNSEE, WHITES, AND NEGROES. PAIRED BONES

MALES

	Right			Left		
	Diameter maximum	Diameter minimum	Index	Diameter maximum	Diameter minimum	Index
Munsee:	<i>cm.</i>	<i>cm.</i>		<i>cm.</i>	<i>cm.</i>	
Specimens.....	(15)	(15)	(15)	(15)	(15)	(15)
Average.....	3.23	2.37	73.3	3.33	2.38	71.6
United States whites:						
Specimens.....	(66)	(66)	(66)	(66)	(66)	(66)
Average.....	3.25	2.69	82.8	3.24	2.73	84.1
United States negroes:						
Specimens.....	(6)	(6)	(6)	(6)	(6)	(6)
Average.....	3.07	2.68	87.3	3.17	2.73	86.3

FEMALES

Munsee:						
Specimens.....	(12)	(12)	(12)	(12)	(12)	(12)
Average.....	2.88	2.17	75.5	3.03	2.17	71.7
United States whites:						
Specimens.....	(28)	(28)	(28)	(28)	(28)	(28)
Average.....	2.94	2.39	81.1	3.0	2.39	79.6
United States negroes:						
Specimens.....	(7)	(7)	(7)	(7)	(7)	(7)
Average.....	3.02	2.42	80.1	2.97	2.44	82

It will be observed, in the first place, that at the middle of the shaft the mean of the two diameters at the upper flattening in the Munsee is smaller in both sexes and on both sides than that in either the whites or the negroes, thus indicating that the bone is more slender.

The most striking points brought out by the data are, however, those relating to the degree of the flattening in the subtrochanteric region in the different racial groups. The Munsee femora are decidedly flatter than those of the whites, which in turn are slightly flatter than those of the negro. As a result the platymetric index in the Munsee is considerably below that in both the other races.

Taking the two diameters separately it will be observed that the diameter maximum or breadth is frequently larger in the left than in the right femur. This is true in both sexes among the Munsee and in the white females and negro males. In the white males the measurement is equal on the two sides, and in the negro females it is slightly larger on the right than on the left. In all probability the tendency of the left femur to be slightly broader than the right at the subtrochanteric flattening is quite universal.

The lateral diameter or thickness is also slightly larger in the left femur in nearly all the racial and sex groups, but the excess is less than with the breadth. It is thus evident that the left femur at this point is in general slightly stronger than the right. But, as already indicated, the mean excess in breadth is mostly greater than that in thickness, the result of which in most of the groups is a slightly lower platymeric index on the left side.

As to sexes, the platymeric index in the Munsee is slightly higher on both sides in the females than in the males. This is exceptional for Indians, the condition being usually the reverse. In the United States whites and United States negroes, and in Indian tribes other than the Munsee examined by the writer, the male femur as a rule gives a somewhat higher average index on both sides than the female, indicating that the flattening in the male is of lesser degree.

As to the sides, in the majority of the groups, and particularly in the Munsee, the right platymeric index is slightly higher than the left. In the Arkansas and Louisiana Indians it was very nearly equal on the two sides in both sexes. In the series of United States white males used here for comparison, and in the United States negro females, the right index is higher. Evidently, while the preponderant tendency is for the right platymeric index to be slightly higher than the left, there are not infrequent exceptions, but the differences are not of much importance.

To summarize, it may be stated that at the subtrochanteric flattening the Munsee femur shows a decidedly greater compression than the femora of the United States whites, and especially those of United States negroes; it shows a slightly greater relative flatness in the male than in the female, which is exceptional; and in the majority of cases it is relatively slightly flatter on the left than on the right side of the body.

These details may seem rather involved, and perhaps in some instances of no great consequence. But when at some time we shall be able to examine scores of records where we have now but few, and each series of records extending to hundreds instead of to only tens of specimens, the above points will assume a definite morphological importance, demonstrating on the one side the presence of astonishingly uniform and persistent laws relating even to secondary characteristics of bones, and, on the other, to clear, conspicuous, racial sexual and other group differences.

SPECIAL CHARACTERISTICS OF THE FEMORA

As to special descriptive characteristics of the Munsee femora, special attention was paid to the *linea aspera*, the shape of the shaft at middle, and the presence and development of the third trochanter.

Linea aspera.—The linea aspera was found to be generally well developed, but seldom high and in no case excessively rough, indicating well but not exceptionally developed musculature.

Shape of the shaft.—As to the shape of the shaft at middle, in a fourth of the males and in nearly half the females this was found to be more or less prismatic, and in 9 per cent of the males and 7.5 per cent of the females, plano-convex; the remainder of the bones showing, with one exception, intermediary or not well-defined shapes. None of the femora present the cylindrical (juvenile) type, or type 4 (anterior surface divided in two by a long vertical ridge), and in but one bone is the shape clearly elliptical. Among the whites the last named (elliptical) form is much more common, while the plano-convex type is less frequent than in the Indians.¹

Third trochanter.—Respecting the third trochanter, this presents itself as a more or less marked ridge, or an oblong tuberosity, or a round tuberosity; and in any of these forms it may be slight, medium, or pronounced. In some instances there will be found a depression, instead of an elevation, in the bone at or near this locality. These different forms have no separate morphological significance. They all serve for or are due to the attachment of the gluteus maximus muscle, and merge into each other by transitional stages. In the Munsee, conditions in regard to the third trochanter were as follows:

L. MUNSEE AND WHITE FEMORA: THIRD TROCHANTER OR GLUTEAL TUBEROSITY

	Subjects	Third trochanter absent	Ridge		Oblong tuberosity		Round tuberosity	
			Moderate	Pronounced	Moderate	Pronounced	Moderate	Pronounced
Munsee:		<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
Male.....	(17)	30	40	.....	26	.....	6	.....
Female.....	(14)	32	36	.....	22	3.5	3.5	3.5
Whites:								
Male.....	(200)	43	32	4.5	9	5	3.5	3
Female.....	(120)	45	31	5	12.5	1.7	5	.....

It is here seen that the third trochanter is strictly absent in less than a third of the male as well as of the female bones of the Munsee; a small to pronounced oblong tuberosity exists in 26 per cent of the males, and practically the same proportion (25.5 per cent) of the females, while a rounded tuberosity is found in 6 per cent of the males and in 7 per cent of the females. Among the previously reported Arkansas and Louisiana Indian femora, the frequency of the third trochanter in most of its forms was somewhat greater. Among the ordinary American whites, it will be observed from the above figures, there is in both sexes a more frequent complete absence of the third

¹ Compare *Arkansas and Louisiana Femora*, op. cit., p. 217.

trochanter in any form than in the Munsee; there is less frequency of the moderate ridge and moderate oblong tuberosity; and a greater frequency of pronounced grades of both ridge and oblong tuberosity, while the occurrence of round tuberosity is about even in the two groups. Subtrochanteric fossa in place of or beside a prominence was observed in Munsee adults in five cases—four males and one female. In adolescents it was more frequent.

TIBIA

The results of the several measurements obtained on the Munsee tibiæ are shown below.

The mean length of the bone, taking the two sides together, is 38.5 cm. in the males and 35.3 cm. in the females. The length of the female bone stands to that of the male as 91.7 to 100, which is lower than was obtained on the tibiæ from Louisiana, where the proportion was 93.7, or than that prevailing among whites, where it is even slightly higher (94.6 in miscellaneous New York whites). The Munsee female tibiæ are therefore relatively somewhat short, paralleling to some extent what was found with reference to the radius. Lesser differences of the same nature is found in probably all larger racial groups. Why the feature should be more pronounced in the Munsee than in other Indians is difficult of explanation; but, as will be seen later, this is not the only peculiarity of the female Munsee tibiæ.

LI. MUNSEE: TIBIÆ

MALES

	Right							
	Number of bones	Length*	Number of cases	Diameter † antero-posterior at middle	Diameter † lateral at middle	Index of shaft at middle $\frac{b \times 100}{a}$	Number of cases	Tibio-femoral index $\frac{T \times 100}{F}$
				(a)	(b)			
Average:		cm.		cm.	cm.			
Paired.....	(11)	38.3	(14)	3.28	2.14	65.4	(19)	84.4
Total present.....	(12)	38.5	(14)	3.28	2.14	65.4	(10)	84.6
Minimum.....	(12)	36	(14)	3.05	1.95	56.3	(10)	81.1
Maximum.....	(12)	40.5	(14)	3.55	2.4	69.7	(10)	86.9
	Left							
	Number of bones	Length*	Number of cases	Diameter † antero-posterior at middle	Diameter † lateral at middle	Index of shaft at middle $\frac{b \times 100}{a}$	Number of cases	Tibio-femoral index $\frac{T \times 100}{F}$
				(a)	(b)			
Average:		cm.		cm.	cm.			
Paired.....	(11)	38.6	(14)	3.25	2.16	66.6	(9)	84.5
Total present.....	(12)	38.8	(15)	3.23	2.16	67.1	(11)	84.9
Minimum.....	(12)	36.7	(15)	2.8	1.95	54.9	(11)	79.4
Maximum.....	(12)	40.9	(15)	3.55	2.4	80.4	(11)	90.0

* On Broca's *planche ostéométrique*, with the spine in the opening of the vertical portion of the instrument and the condyles applied to the board on both sides of the opening, the rest of the bone lying immobile on the horizontal board.

† Maximum.

‡ With anterior border of the bone midway between the two branches of the compass that are applied to the sides of the bone.

LI. MUNSEE: TIBIÆ—Continued

FEMALES

	Right							
	Number of bones	Length	Number of cases	Diam-eter antero-posterior at middle	Diam-eter lateral at middle	Index of shaft at middle $\frac{b \times 100}{a}$	Number of cases	Tibio-femoral index $\frac{T \times 100}{F}$
				(a)	(b)			
Average:		cm.		cm.	cm.			
Paired.....	(13)	35.3	(13)	2.6	1.98	76.1	(12)	83.7
Total present.....	(14)	35.3	(13)	2.6	1.98	76.1	(12)	83.7
Minimum.....	(13)	32.4	(13)	2.25	1.65	70.2	(12)	81.4
Maximum.....	(13)	37.1	(13)	2.85	2.3	86.7	(12)	87.7
	Left							
	Number of bones	Length	Number of cases	Diam-eter antero-posterior at middle	Diam-eter lateral at middle	Index of shaft at middle $\frac{b \times 100}{a}$	Number of cases	Tibio-femoral index $\frac{T \times 100}{F}$
				(a)	(b)			
Average:		cm.		cm.	cm.			
Paired.....	(13)	35.2	(13)	2.6	1.93	74.5	(12)	83.7
Total present.....	(14)	35.2	(14)	2.64	1.96	74.6	(12)	83.7
Minimum.....	(14)	32.4	(14)	2.25	1.5	58.8	(12)	81.5
Maximum.....	(14)	36.7	(14)	2.8	2.35	82.2	(12)	86.1

As to the two sides, the Munsee left tibia averages somewhat longer in the males than the right, which on the whole in slight measure is also the condition among the whites, but to which individual and even group exceptions are not infrequent. In the Munsee females, on the other hand, the average length of the left tibia is slightly less (by 1 mm.) than that of the right.

The percental relation of the length of the tibia with the bicondylar length of the femur, or the *tibio-femoral index*, averages in whites approximately 82 in the males and slightly less in the females. In the Munsee it is somewhat more elevated in both sexes. As in the whites and other racial groups, a moderate excess of the male over the female index is present on both sides, indicating the slightly greater relative shortness of the female leg bones aforementioned. Judging from the available data on the tibio-femoral index among other Indians,¹ that in the Munsee comes very near to the average of the race.

The strength of the Munsee tibia (and the same is probably true of many other Indian tribes) is surprising, being nearer that of the whites than is the case with either the humerus or the femur. The antero-posterior diameter of the Indian tibia is, in fact, in almost all the Indian groups somewhat greater than in the whites. The index of the shaft is invariably and quite perceptibly lower in the Indians

¹ Compare S. Bello y Rodriguez, *Le fémur et le tibia, chez l'Amérindien et les anthropoïdes*, Thèse, Paris, 1909, p. 109.

than in the whites, excepting the Munsee females, in whom, curiously enough, the index is relatively quite high, exceeding both that of the other Indians available for comparison and of the whites. No satisfactory explanation of this and other exceptional features of the Munsee tibia can be given. The condition can scarcely be regarded as accidental, for on examining the individual shaft indexes it is observed that in but one of the female bones is the index below 60, giving thus a pronounced platynemy; in five it is between 60 and 70; in ten between 70 and 80, and in no fewer than eleven it rises to 80 or over. Among the twenty-nine male Munsee tibiae there is but one that gives a shaft index of slightly above 80.

LII. MEAN DIMENSIONS OF THE TIBIA (THE TWO SIDES BEING TAKEN TOGETHER)
IN THE MUNSEE AND OTHER INDIANS, AND IN WHITES

	Length	Mean diameter antero- posterior at mid- dle* (a)	Mean diameter lateral at middle* (b)	Module†	Index of shaft at middle $\frac{b \times 100}{a}$	Tibio- femoral index $\frac{T \times 100}{F}$
Males:	cm.	cm.	cm.	cm.		
Munsee.....	38.45	3.27	2.15	2.71	66	84.45
Arkansas.....	38.4	3.35	2.18	2.76	65.15	82.35
Louisiana.....	37.1	3.3	2.2	2.75	68.47	84.25
Whites (miscellaneous).....	36.5	3.14	2.22	2.68	71.1	82
Females:						
Munsee.....	35.25	2.6	1.96	2.28	75.3	83.7
Arkansas.....	33.15	2.8	1.98	2.39	69.25	82.35
Louisiana.....	34.75	2.9	1.88	2.39	64.2	83.9
Whites (miscellaneous).....	34.56	2.65	1.96	2.3	71.9	81.6

* $\frac{\text{Right} + \text{left}}{2}$

† $\frac{\text{Diameter antero-posterior} + \text{diameter lateral, right and left.}}{4}$

The Munsee tibiae, barring a few moderate inflammatory lesions referred to in another section, are normal throughout and free from anomalies. The inclination of the head is in no case especially marked.

As to the shape of the shaft at middle, conditions were found as follows:

LIII. MUNSEE TIBIÆ: SHAPE OF SHAFT AT MIDDLE*

	1	2	3	4	5	6	I
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Males.....	11	13.5	7	24	3.5	.....	41
Females.....	44	11	.....	15	3.5	.....	26

*1=ordinary prismatic; 2=lateral prismatic; 3=external surface concave; 4=posterior surface divided into two by vertical ridge; 5=interior border indistinct, posterior half of bone oval; 6=plano-convex; I=indefinite.

It is interesting to note that in the female Munsee tibia, type 1 is decidedly frequent and much more common than in the males; type 3, which is usually associated with considerably developed leg muscles, is absent in the females; type 4 is relatively frequent in both sexes; type 6 is wholly absent.

In the next table are shown for comparison the proportions of the different types found by the author in different racial groups. For the purpose of elucidating these data, both sexes are taken together. It is seen that well-differentiated type 1 is most common in the Indians; that type 2 is relatively scarce in the negro; type 3, most common in the white (laboring class), was not met with in a pronounced form in the negro; type 4 is decidedly more common in the Indian than in the other two races; and type 6, absent in the Indians and rare in the whites, is fairly frequent in the negro. These differences show that the shape of the shaft of the tibia, as that of the femur, humerus, and other bones, has a considerable racial significance, which, as our data are increased, will doubtless become accentuated.

LIV. COMPARISON OF MUNSEE AND OTHER INDIAN WITH WHITE AND NEGRO TIBIÆ WITH REFERENCE TO SHAPE OF SHAFT AT MIDDLE*

Types	1	2	3	4	5	6	I
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
Munsee (all—56).....	27	12	3.5	20	3.5	.....	34
Arkansas and Louisiana.....	.....	.....	.....	.....	.....	.....	.....
Miscellaneous whites (1975).....	18	15	9	5	5	2	45
United States negroes (55).....	20	9	.....	7	7	11	45

* For the significance of the denominations see the note to the preceding table.

FIBULA

While of secondary importance, the fibula often presents interesting features which make it worthy of closer attention than it usually receives. One of these features concerns its length on the two sides of the body, which, in some Indians at least, is more uniform than that of its companion bone, the tibia. It was found so by the writer in the skeletal collections from Arkansas and Louisiana mounds, and the feature appears again in the Munsee. The slight differences presented by the Munsee fibulæ in this particular harmonize with those of the tibiæ.

The percental relation of the female to the male fibula averages 93.5 (the male bone = 100), while in the tibia it was only as 91.7 to 100.¹ This anomaly is due to the unexplained relative shortness of the female Munsee tibiæ.

¹ Taking only cases where all four bones of one body are available for measurement, we obtain 92 for the relation of female to male tibiæ and 94.6 for that of the fibulæ, numbers which stand to each other very much as do those above given.

As to the shape of the shaft, which in the fibula differs more than in any other bone, the prevalent tendency, as in the Arkansas and Louisiana specimens, is toward type 2, or the lateral prismatic; a good many of the bones, however, show also a more or less marked fluting of one or two of the surfaces. The details are given in the following table:

LV. MUNSEE FIBULA: LENGTH

	Males				Females			
	Right		Left		Right		Left	
	Number of bones	Length, maximum	Number of bones	Length, maximum	Number of bones	Length, maximum	Number of bones	Length, maximum.
Average:		<i>cm.</i>		<i>cm.</i>		<i>cm.</i>		<i>cm.</i>
Paired.....	(5)	36.9	(5)	37	(4)	34.9	(4)	34.8
All.....	(6)	37.1	(6)	37.1	(9)	34.7	(7)	34.7
Minima.....	(6)	35.3	(6)	35.8	(9)	32	(7)	31.8
Maxima.....	(6)	39	(6)	38.8	(9)	36.8	(7)	36.9

LVI. MUNSEE AND OTHER INDIAN FIBULÆ—SHAPE OF SHAFT AT MIDDLE*

Types ¹	Males						Females					
	1	2 and 2a	3	5	6	4	1	2	3	5	6	4
	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
Munsee.....	4	48	4	15	11	18	5	32	18	5	14	27
Arkansas and Louisiana....	27	40	9	9	3	12	17	42	4	4	17	17

*1=Ordinary quadrilateral, approaching prismatic; anterior surface nearly absent to moderate; posterior surface facing directly backward or nearly so. 2=Lateral prismatic; posterior surface facing backward and inward; medial surface much less in area than lateral; anterior surface narrow to broad. 2a=Relation between medial and lateral surface reversed, the latter being the narrower. 3=Medial surface fluted. 4=Lateral surface differentiated into two surfaces. 5=Lateral surface fluted. 6=Both medial and lateral surfaces fluted.

CLAVICLE

The Munsee clavicle, in paired bones and in average, measures 15.3 cm. in length on the right and 15.25 cm. on the left in the males, and 13.7 cm. on the right with 13.9 cm. on the left in the females. This gives the ratio of 90.4 (female) to 100 (male), which is lower than that in any of the long-bones and indicates a relative shortness of the clavicle in the Munsee females.

The right clavicle is very slightly longer than the left in the male, but is perceptibly shorter than the left in the female skeletons. One pair of the male and a pair of the female bones show pronounced curves; otherwise there is nothing special. The strength of the bones is moderate to medium; none is massive.

LVII. MUNSEE CLAVICLE: LENGTH

	Males				Females			
	Right		Left		Right		Left	
	Number of bones	Length, maximum	Number of bones	Length, maximum	Number of bones	Length, maximum	Number of bones	Length, maximum
Average:		cm.		cm.		cm.		cm.
Paired.....	(8)	15.35	(8)	15.3	(9)	13.7	(9)	13.9
All.....	(9)	15.4	(10)	15.3	(11)	13.8	.....	.....
Minima.....	(9)	14.4	(10)	14.2	(11)	12.7	(9)	12.9
Maxima.....	(9)	16.5	(10)	16.3	(11)	14.9	(9)	15.6

STERNUM

The total number of sterna present is 14, 8 males and 6 females. In 13 of these specimens the manubrium is completely detached, which in general is the most usual condition, while in the 14th there is partial attachment. Much the same condition was found by the writer in the Indian sterna from Arkansas and Louisiana.

The measurements of the sternum, given in the next table, are found to be moderate throughout. Unfortunately there are few available measurements of the sternum in other races for comparison.

LVIII. MUNSEE STERNUM: DIMENSIONS

MALES

	Number of bones	Total length (less xiphoid and episternals)* (a)	Greatest breadth of body (b)	Sternal Index $\frac{b \times 100}{a}$	Maximum thickness of body
Average:		cm.	cm.		cm.
Paired.....	(6)	15.7	3.7	23.8	1.2
All.....	.....	15.7	3.7	23.8	1.2
Maxima.....	All.....	14.6	3.4	21.1	1
Maxima.....	All.....	17.5	4.2	25.8	1.3

FEMALES

Average:					
Paired.....	(6)	13.8	3.5	25.7	0.9
Average.....	All.....	13.8	3.5	25.7	0.9
Minima.....	All.....	12.8	2.8	21.5	0.8
Maxima.....	All.....	16.2	3.9	30.5	1

* Where present and attached to upper sternal tubercle (three instances).

As to the rib facets, two of the 11 sterna in which the notches can be counted show seven on each side; in female skeleton no. 285,307, with normal number of ribs, there are seven notches on the right and but six on the left; in female no. 285,311, with 24 regular ribs

and a right cervical, there are six facets on the right and seven on the left, and all the facets on the right side are situated perceptibly higher than those on the opposite side of the bone; in four instances there are six facets on each side; in two (male no. 285,301 and female no. 285,330, the former with the normal number of ribs and the latter uncertain) the sternum shows six facets on the right and but five on the left side; finally, in female no. 285,310, with 24 ribs, we find but five sternal facets on each side—this subject, however, was not fully adult. These details show that there are considerable irregularities in the sternal facets among the Munsee, even in the presence of the normal number of ribs.

The antero-posterior curvature of the Munsee sternum ranges from slight to moderate. The xiphoid appendix is attached to the body of the sternum in only one instance—a male. In one male (no. 285,314) the left clavicular facet is considerably larger than the right.

Three of the male and one female sterna show on one or both sides attached episternal tubercles. In three of the cases the anomaly is unilateral—twice left and once right—while in one of the males it is bilateral, but the tubercle is more pronounced on the left.

The breadth-length index of the sternum shows considerable individual variation in both sexes, but on the average it is higher in the females, the bone in this sex being relatively shorter.

SCAPULA

GENERAL FEATURES

This is one of the most interesting bones of the body, and although it has been reported on by a number of observers, it presents a variety of features that deserve further study. It is a bone which in all particulars shows great individual variation, but on close scrutiny it is found that these variations differ more or less from group to group and are therefore of anthropological importance, and that they are subject to certain laws which evidently are universal to human kind.

In collections derived from graves, such as those of the Munsee, the scapulæ, on account of their frailness, are often damaged, so that relatively few specimens are available for examination. There are nevertheless in the Munsee collection five male and nine female bones in fair condition, and their study gives some satisfactory results. To contrast these results properly the writer presents in the following table data not only of the Munsee, but also those on several other Indian groups as well as on the whites and the United States negroes.

LIX. MUNSEE SCAPULÆ: COMPARISON

	Specimens	Total height	Infra-spinous height	Breadth	Scapular index	Infra-spinous index
MALES						
		<i>cm.</i>	<i>cm.</i>	<i>cm.</i>		
Munsee.....	(4)	15.2	11.2	10.6	69.5	94.2
Southern Utah cliff-dwellers.....	(18)	15.1	11.6	10.15	67.4	87.7
Pima and Pueblo.....	(5)	15.5	12	11.05	71	93
Various Mexican Indians.....	(9)	15.8	12	10.4	65.5	86.6
Indians, Peru.....	(55)	15.83	12	10.17	64.2	84.8
Indians, Peru (Livon) ¹	(17)	15.1	11.3	10	63.8	85.6
United States whites (various nationalities).....	(70)	16.4	12.25	10.7	65.3	87.3
Whites (Livon) ¹	(73)	16.8	12.4	10.6	63	85.5
United States negroes.....	(46)	16.25	11.6	10.9	66.8	92.1
FEMALES						
Munsee.....	(9)	13.9	10.4	9.9	70.7	95.3
Southern Utah cliff-dwellers.....	(10)	13.7	10.25	9.7	70.6	94.2
Pima and Pueblo.....	(5)	13.8	10.25	9.95	72	97
Various Mexican Indians.....	(12)	13.75	10.25	9.75	70.7	94.8
Mexican Indians ² (Livon) ¹	(2)	13.17	10.16	10.17	77.2	100
Indians, Peru.....	(39)	13.78	10.47	9.17	66.5	87.4
Indians, Peru (Livon) ¹	(6)	13.5	10	9	67	88.4
United States whites (various nationalities).....	(44)	14.4	10.9	9.6	66.7	88.4
Whites (Livon) ¹	³ (51)	(13.5)	(10.25)	(9.1)	67.5	88.4
United States negroes.....	(18)	14.2	10.2	9.25	65	90.1

¹ M. Livon, *De l'omoplate*, etc., Thèse, Paris, 1879, pp. 41-42.² One subject.³ The averages of the measurements are exceptionally small in this series.

The above data show that the Indian scapula is on the whole somewhat smaller than that of either the whites or the American negroes except in the females, where the bone, while shorter, is slightly broader than that in the other two races. The Munsee scapula compare fairly well with those of other Indian tribes, the apparent differences being doubtless due in a measure to the small number of specimens.

The scapular index in the Munsee is high, indicating that the shortness of the bone is both absolute and relative. The different Indian tribes offer considerable variation in this respect, but, as will be noted except in the Peruvians, the index in all is above that of the white and in the majority of cases even above that of the negroes. These high scapular indexes in the Indian approximate those of the anthropoid apes, but it remains to be determined if the phenomenon in the two genera is homologous.

In the female Munsee the scapular index is perceptibly higher than in the males, and this characteristic, owing to a relatively greater breadth of this bone in the females, is common to all the other given groups, excepting the negro.

The infraspinous index is also high in the Munsee as compared with other Indians, the whites, and even the negroes. This is particularly the case in the males, in whom the infraspinous height is exceptionally low.

The female index again exceeds that of the males in the Munsee and in all other Indian groups, as well as in the whites, owing to the relatively greater breadth of the female scapula. The negroes show here once more an exception to the rule, and it would be interesting to trace how far this peculiarity may be prevalent in that race.

High indexes, such as those of the Indians, have been reported by Livon, Broca, Ranke, and others,¹ among some of the African negroes, the Melanesians, the Malays, the Guanches, and the Egyptians.

DESCRIPTIVE FEATURES

The principal points for visual observation to which attention has been given in this instance were (a) the shape of the scapula as a whole, with the development of the *teres major* region; (b) the form of the superior border of the bone; and (c) the development of the notch in the superior border.

Type of body.—The scapula as a whole may be more or less neatly triangular or wedge-shaped, which form will be designated as type 1. Again, it may be more acutely wedge-shaped, with both its axillary and vertebral border markedly concave, a type which the author classes as 3.² It may be quadrilateral, type 4, with the axillary border augmented by a shorter but well-marked inferior border, due to a development of a process or angle by the influence of the *teres major* muscle. It may be pentagonal, when the preceding type is augmented by a distinct angle in the axillary border at or above the spine, which divides it into two well-marked borders—type 5. Finally, we may have a shape resembling that in many lower mammals and characterized by marked convexity of the axillary border, which will be referred to as type 6.

Among the 19 Munsee scapulæ, a large majority show types 4 and 5, the few remaining specimens approaching type 1. There is no instance of the relatively rare type 3, nor of type 6, which is quite common in other Indians, particularly the males. The following table gives several series of records for comparison, including that of

¹ For literature, see R. Martin, *Lehrbuch der Anthropologie*, 1914; also A. C. Schüek, *Das Schulterblatt des Menschen und der Anthropoiden*, *Mittel. Anthr. Ges. Wien*, XL, 1910.

The few published reports on Indian scapulæ give scapular and infraspinous indexes as follows: Matiegka (Santa Rosa, Cal., Indians), 64.9; 90.8; Dorsey (Northwest Coast), 65.1; 83.2 (?); Martin (Fuegians), 65.4; 90.8; Martin (Peruvians), 66.6; 89; Matthews (Ancient Pueblos of Arizona), 71.1.

In the anthropoid apes the scapular index averages between 69 and 76 (Livon); but the infraspinous index is enormous, ranging from slightly over 100 in the orang to 156 in the chimpanzee.

² This form and various approaches to it have been referred to as "scaphoid" by Graves (*Jour. Amer. Med. Assn.*, 1910, p. 12), and wrongly attributed to faulty development of the body.

United States whites. Analysis of the data shows some marked sexual as well as racial differences, the full value of which can not, however, be determined in the absence of more ample records. It is very plain, however, that type 1, or a close approach to it, and types 3 and 5 are, on the whole, more common in the females than in the males; while type 6 is decidedly more frequent in the males. Type 3 is relatively frequent in the whites, type 5 relatively scarce. In all probability the Indians differ considerably among themselves with respect to the shape of the scapulæ, as shown by the Munsee and Peruvian males, though the two series of specimens are very unequal in numbers. Minor differences in records of this nature can not be given any weight, for naturally the matter of classification of the different shapes is less perfect than that of accurate measurements.

LX. THE FORM OF THE SCAPULA: MUNSEE AND COMPARATIVE

MALES

People	Specimens	Indefinite	Type 1 or near 1	Type 3	Type 4*	Type 5	near 5	Type 6	near 6
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
Munsee.....	(8)		12		38	50			
Peruvian Indians.....	(57)	10.5	21	3.5	5	5		37	17.5
United States whites (miscellaneous).....	(168)	4.8	28	9.5	9.5	17.9	7.7	14.3	8.3
United States negroes.....	(40)		22.5	5	17.5	32	2.5	15	5

FEMALES

Munsee.....	(11)		27		27	27	18		
Peruvian Indians.....	(38)		29	5	5	39	11	8	3
United States whites (miscellaneous).....	(118)	1.7	32.2	13.6	15.2	16.1	8.5	8.5	4.1
United States negroes.....	(16)			25	19	37.5	6		12.1

* The fourth, or *teres major*, border is present also, of course, in all instances of type 5, and in most specimens of type 4. It is particularly common in the Peruvian scapulæ.

Superior border.—The form of the superior border of the scapula can be divided for purposes of description into (1) horizontal or slightly rising and forming a right or nearly right angle with a vertical line passing upward from the base of the coracoid; (2) moderately rising or oblique and straight or but slightly curved, forming with the coracoid vertical an angle of between 85 and 55°; (3) markedly oblique, forming with the coracoid vertical an angle of less than 55°; (4) angular or deep saddle-shaped, which is of special importance anthropologically; and (5) markedly concave or semilunar (see pl 25). In rare instances a form (6) occurs, in which the border is low and moderately convex, and another (7) in which it is marked:

a*b*

a THE SEVENTH CERVICAL VERTEBRA OF FEMALE MUNSEE SKELETON NO. 285,311, U.S.N.M., WITH A CERVICAL RIB

b SCAPULA OF FEMALE MUNSEE SKELETON NO. 285,328, U.S.N.M., SHOWING SEMILUNAR SHAPE OF THE SUPERIOR BORDER

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concavo-convex; and, finally, there occurs now and then an indeterminate form (I), which can not be classified.

LXI. FORM OF THE SUPERIOR BORDER OF THE SCAPULA IN THE MUNSEE AND IN OTHER RACIAL GROUPS

Group	Specimens	Types*						
		1	2	3	4 and near 4	5 and near 5	6	7
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
Munsee.....	(16)	.....	.....	31.2	25	43.8	.....	.....
Northwest Coast Indians.....	(82)	6.7	27.5	35.4	25.6	4.9	.....	.....
Southern Utah cliff-dwellers.....	(53)	16.9	54.7	20.7	7.6	.....	.....	.....
Mexican Indians.....	(41)	37.8	39.1	15.8	4.8	2.4	.....	.....
Peruvian Indians.....	(95)	.....	37.9	15.8	17.9	26.3	.....	(†)
United States whites (miscellaneous).....	(1,032)	15	48.5	11	8.2	16.7	0.3	0.5

*Type 1=horizontal or but slightly inclined; 2=moderate to medium obliquity; 3=pronounced obliquity; 4=deep saddle-shaped; 5=semilunar; 6=convex; 7=markedly concavo-convex.

†In two specimens (2 per cent) the form of the border was unclassifiable.

The data obtained in this particular on the Munsee and other Indian groups, as well as on a large series of whites, are given in the next table. It is very evident that racial and tribal differences of some importance exist in the shape of the border. Among the whites its most common form is type 2, or moderate to medium oblique, pronounced obliquity being infrequent; types 4 and 5 occur but rarely. In the Munsee there is a curious but doubtless local prevalence of the semilunar type 5, the next most frequent form being that of pronounced obliquity; and one-fourth of the cases show the saddle form or an approach to it. Among other Indians the conditions differ. The cliff-dwellers of southern Utah come, on the whole, near to the whites; among the Mexican Indians low borders prevail, while among the Northwest Coast tribes we find the opposite condition—high borders, with a relative frequency of the angular or saddle-shaped type (4 or near 4). It is an interesting fact that the last named form (4) is frequent and often highly developed in the Eskimo.

The question occurs as to how the form of the superior border differs in the two sexes and on the two sides, and the next table throws some light on these problems. It will be observed that among the Indians the differences between the males and the females are not striking, though there is a tendency toward greater obliquity of the border in the males. Among the whites, types 1 and 4 are more common in the females than in the males; type 2 occurs about the same number of times in the two sexes, while types 3 and 5 are more frequent in the males.

LXII. FORM OF THE SUPERIOR BORDER IN MUNSEE AND OTHER INDIAN SCAPULÆ
ACCORDING TO SEX AND SIDE

Sex and side	Specimens	Types						
		1	2	3	4	2-4	3-4	5
Males (both sides).....	(84)	<i>Per ct.</i> 11.9	<i>Per ct.</i> 34.5	<i>Per ct.</i> 33.3	<i>Per ct.</i> 5.9	<i>Per ct.</i> 3.6	<i>Per ct.</i> 3.6	<i>Per ct.</i> 71
Females (both sides).....	(110)	20	35.5	21.8	5.5	4.5	7.3	5.5
Right (both sexes).....	(104)	18.3	33.6	22.1	8.7	5.8	6.7	4.8
Left (both sexes).....	(90)	14.4	37.8	31.1	2.2	2.2	4.5	7.8

As to the two sides, we find that a slightly lesser tendency to marked obliquity of the border exists in the left than in the right scapula; while the bone of the right side shows greater frequency of the angular or deep saddle-shaped (type 4 or near 4).

Scapular notch.—The notch in the scapular border, at the base of the coracoid, which, as is well known, transmits the suprascapular nerve, may be absent, shallow, medium deep, or converted into a complete foramen. Among the 21 scapulæ of the Munsee and 431 of whites, the conditions in this respect, with reference to sex and side, are as follows:

LXIII. SCAPULAR NOTCH IN THE MUNSEE AND IN WHITES

Sex	Specimens	Form 1 (absent)	Form 2 (shallow)	Form 3 (medium)	Form 4 (deep)	Form 5 (complete foramen)
Munsee:		<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
Male.....	(9)	.....	22	.....	67	11
Female.....	(12)	8	66	.....	16	.....
Peruvian Indians:						
Male.....	(57)	3.5	15.8	70.2	10.5	.....
Female.....	(37)	5.4	24.3	67.6	2.7	.....
Whites:						
Male.....	(267)	0.7	15.4	57.3	22.8	3.7
Female.....	(164)	3.7	15.2	64	16	1.2
Side						
Munsee:						
Right side.....	(11)	.....	40	.....	50	20
Left side.....	(10)	10	60	.....	30	.....
Peruvian Indians:						
Right side.....	(50)	4	22	68	6	.....
Left side.....	(44)	4.5	15.9	70.5	9.1	.....
Whites:						
Right side.....	(215)	2.3	14	62.3	18.6	2.8
Left side.....	(216)	1.4	17.6	56.5	21.8	2.8

It is plain that while among the whites the medium form of the notch very largely predominates, among the Munsee this form is absent, though this is doubtless accidental to some extent at least, owing to the relatively small number of specimens. The complete foramen is much more frequent in the Munsee than in the whites.

As to the sexes, in both the Munsee and the whites there is observable a predominance of the deeper forms and the complete foramen among the males, and of the shallower forms and the complete absence of the notch in the females.

As to sides, no characteristic differences in the notch appear.

RIBS

Owing to careful collection, a large majority of the ribs from the Munsee cemetery were preserved and are with their respective skeletons, thus facilitating their study. Furthermore, we possess nearly all the bones of the spines, which show the rib facets.

The ribs present are marked throughout by medium and normal development. Fractures are very rare, there being only two (in one subject) among the 166 ribs of the males, and but one in 196 ribs of the females.¹ This speaks well for the peaceful life of the community.

The number of ribs is normal (24) in every one of the adult males; among the females, however, there are two interesting anomalies—namely: In female no. 285,311 there are 25 ribs, the additional one being well developed, 6.5 cm. long, right cervical; this rib approaches the form of the ordinary first rib, while both the latter are unusually long, being about one-third longer than any of the other female first ribs in the series. The spinal formula in this case, curiously enough, is only 7-12-4, the fifth lumbar being attached to the sacrum. The second anomaly is present in female skeleton no. 285,321, with the spinal formula of 7-11-5, and consists of the absence of the last pair of ribs. The congenitally absent dorsal vertebra is the twelfth.

The first rib generally repays special examination, particularly as to its shape. This shows three main types—(1) the curved; (2) the mono-angular or pistol-shaped, with a nearly straight neck and straight body; and (3) the biangular, in which, besides the angle between the neck and the body, there is another distinct angle in the body itself, so that the rib appears as if it consisted of three segments. In the relative frequency of these forms the author has reason to believe will be found to differ in the race and sex, but as a rule it is the same on both sides. In the Munsee the shapes found were as follows:

LXIV. MUNSEE: SHAPE OF RIBS

	Subjects	Type 1 or near 1	Type 2 or near 2	Type 3 or near 3
males.....	(10)	Per cent 70	Per cent 20	Per cent 10
females.....	(12)	75	25	.....

Or 8 in 1,000. Among the whites, dissecting-room material, in a total of 16,300 ribs examined, the author found fractures in the first rib in the proportion of 4 in 1,000; in the second rib, 20 in 1,000; and in the ribs below the second, 49.3 in 1,000.

The biangular form, which is fairly frequent in whites, is nearly absent in the Munsee, the one pair in the males presenting merely an approach to the form.

SPINE

The entire number of vertebræ of 21 skeletons has been preserved, thus affording an excellent opportunity for studying the numerical relations of the bones, as well as other particulars.

The bones are entirely normal, with the exception of the frequent slightly to moderately developed marginal exostoses (which, unless premature or excessive, the author regards more and more as the usual manifestations of age rather than of disease), and one case of advanced spondylitis deformans, resulting in fusion of the lower half of the spine and the sacrum. The bones show moderate to medium development and are free from gross anomalies.

As to numbers, the cervical vertebræ show but one exception to the normal—namely, in male skeleton no. 285,326, in which only six vertebræ are present in this region. The locus of the (congenitally) missing one is between the third and the sixth, its exact identity being difficult to determine. In one of the females (no. 285,311) the seventh cervical, as already mentioned, gives attachment on the right to a well developed cervical rib (pl. 25, *a*).

The vertebræ of the dorsal region are also normal in number in all cases but one, which has been mentioned in connection with the ribs; it is no. 285,321, female, and presents a congenital absence of the twelfth vertebra.

The numbers of the lumbar vertebræ show frequent variation. In two of the ten males and two of the eleven females there are but four lumbar, while in one female there are six. In detail we find the following abnormalities:

In male skeleton no. 285,316, the fifth lumbar shows a transitional sacral form, though not attached to the sacrum, and it also presents a detachment of the posterior part of its neural arch.

In male no. 285,326, one of the lumbar vertebræ between the second and fifth is absent congenitally.

In female no. 285,310, one of the lumbar vertebræ is missing congenitally; the last lumbar in this case is in form like the fifth; the upper segment of the sacrum is somewhat lumbar-like, but the bone possesses only five segments and a normal curvature.

In female no. 285,311, with four lumbar vertebræ, the fifth, somewhat modified, is attached to the sacrum (pl. 27).

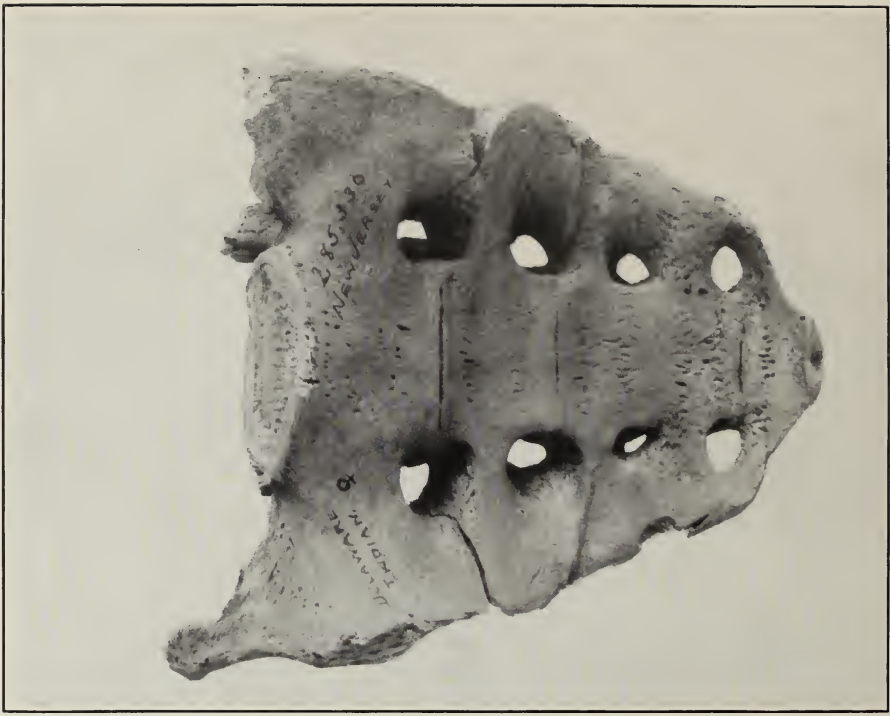
In female no. 285,326, where we have six lumbar vertebræ, the last like the lowest lumbar in male no. 285,316, shows a separation of the posterior portion of the neural arch.

In male no. 285,308, the twelfth dorsal and the first lumbar show complete and evidently congenital pathological fusion.

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a MALE MUNSEE SACRUM SHOWING BILATERAL ARTICULATION BETWEEN THE LAST LUMBAR AND THE SACRUM



b FEMALE MUNSEE SACRUM SHOWING BILATERAL ARTICULATION

SACRUM

GENERAL OBSERVATIONS AND MEASUREMENTS

The total number of serviceable specimens of sacra is 17, only 13 of which, however (six males and seven females), are five-segment bones and sufficiently well preserved to afford the necessary measurements. The results show that, as usual, the male sacrum, while in breadth nearly equal to that of the female, is perceptibly higher, in consequence of which the sacral index, or percental relation of breadth to height, is lower in the males.

A comparison of the Munsee sacra with those of other Indians and United States whites shows marked agreement both in size and in the relative proportions of the bone in the males, but less in the females. As will be seen by the next table, the Munsee female sacrum is somewhat lower than that of any of the other series.¹

LXV. MUNSEE SACRUM: DIMENSIONS

	Males				Females			
	Number of specimens	Height *	Breadth, maximum	Index $\frac{B \times 100}{H}$	Number of specimens	Height	Breadth, maximum	Index $\frac{B \times 100}{H}$
Average.....	(6)	cm. 10.7	cm. 11.6	108.2	(7)	cm. 9.9	cm. 11.7	118.5
Average (including damaged specimens).....	All	-----	-----	-----	(11)	-----	11.5	-----
Minimum (including damaged specimens).....	All	9.9	11.3	102.6	(11)	8.9	11	104.7
Maximum (including damaged specimens).....	All	11.5	12.0	114.1	(11)	10.7	12.8	126.0

* Sacra of five segments only included; height measured with sliding compass, points of instrument applied to middle of promontory and to middle of anterior inferior border of V sacral vertebra.

Emmons, who a few years ago, with the writer's assistance, conducted an examination of 217 Indian female pelvises,² obtained as a total average of his specimens (which however include also sacra of more than five segments), for the height 10 cm., breadth 11.5 cm., and index 115.8—figures which stand in close accord with the above. In the Negro race and in the Australians the sacrum, as is well known, is relatively narrower; and in much larger degree this is also the case in the anthropoid apes. The relatively broad and short sacrum of the whites and the Indians may therefore be regarded as a feature of an advanced evolutionary character.

¹ The sacra from the Arkansas and Louisiana mounds, of which a small series was reported previously by the writer (*Remains from Arkansas and Louisiana*, op. cit.), appeared unusually high; in the much larger series here presented, however, they are seen to form no exception in this respect to those of other Indians.

² A. B. Emmons, A Study of the Variations in the Female Pelvis, Based on Observations made on 271 Specimens of the American Indian Squaw, *Biometrika*, ix, 1913, pp. 34-57.

LXVI. SACRUM: COMPARATIVE DATA

People	Males				Females			
	Number of specimens*	Height	Breadth	Index	Number of specimens	Height	Breadth	Index
Munsee.....	(6)	cm. 10.7	cm. 11.6	108.2	(7)	cm. 9.9	cm. 11.7	118.5
Arkansas and Louisiana mounds.....	(18)	10.95	12.2	111.6	(22)	10.2	11.96	117.2
Southern Utah cliff-dwellers.....	(22)	10.8	11.55	106.9	(10)	10.1	11.33	112.2
Southwest and Mexico...	(15)	10.7	11.36	106.2	(18)	10.4	11.5	110.6
United States whites (various nationalities)†.	‡ (56)	10.62	11.67	109.9	(25)	10.18	11.75	115.4

* Five-segment sacra only.

† There were two separate series which gave remarkably similar results:

(a) Males: (26) H. 10.6, B. 11.7, Ind. 115; females: (12) H. 10.2, B. 11.73, Ind. 115.

(b) Males: (30) H. 10.63, B. 11.64, Ind. 115.8; females: (13) H. 10.16, B. 11.77, Ind. 115.8.

‡ Forty-six additional five-segment adult sacra, both sexes together, gave the writer—height 10.4, breadth 11.76, index 113.

SEGMENTS

Among the eight male Munsee sacra in which determination of the number of segments is feasible, six show five and two show six vertebræ, while among the 12 female bones there are 10 with five and two with six segments. We have thus four six-segmented sacra in 20, or 20 per cent. Emmons, in 217 female Indian pelvises, found six segments in 19.8 per cent of the cases.

Among additional specimens examined by the writer, in 53 sacra of the southern Utah cliff-dwellers, five vertebræ were present in 37, or 70 per cent; six in 15, or 28 per cent; and seven in one, or 2 per cent. Of 42 sacra of Southwestern and Mexican Indians, 31, or 74 per cent, showed five; 10, or 24 per cent, six; and one, or 2 per cent, seven segments. As to whites, among 503 sacra of miscellaneous Americans of both sexes, five segments were present in only 66.4 per cent of the bones; six segments in 31 per cent; seven segments in 2 per cent, and eight in 0.4 per cent, while the whole coccyx was attached, non-pathologically, in one instance. The frequency of more than five vertebræ in the sacrum is therefore slightly to decidedly less in probably all the tribes of Indians than in the United States whites.

CURVATURE

The curvature of the sacrum in the Munsee can be described in 18 of the 20 specimens as medium, while in two (one male and one female) it is submedium. This agrees closely with the author's observations on this feature in other Indians. In the United States whites the proportion of regular and medium forms is smaller, while not infrequently there exists in the sacrum of whites a pronounced



FEMALE MUNSEE SACRUM SHOWING UNILATERAL ARTICULATION
WITH THE LAST FIFTH LUMBAR

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curvature, which is very rare in the Indian. Among 115 Indian sacra from Arkansas, Louisiana, the Southwest, and Mexico, the writer found moderate or medium curvature in 75, or 65 per cent; submedium to slight in 24, or 21 per cent; and pronounced (though never excessively) in 16, or 14 per cent. Among the 217 specimens examined by Emmons, moderate or medium curvature was present in 148, or a little more than 67 per cent; submedium in 52, or 24 per cent; and pronounced in 18, or 8 per cent.

The curve of the sacrum begins in the Munsee (and the same is true of other Indians) in a majority of cases with the first or uppermost segment, but in numerous instances with the second vertebra. More in detail, among the 20 Munsee sacra, in 13, or 65 per cent, the curve began with the first; in six, or 30 per cent, with the second; and in one, or 5 per cent of the cases, with the third vertebra. Among 113 sacra of both sexes from Arkansas, Louisiana, the Southwest, and Mexico, examined by the writer, the curve began in 52, or 46 per cent of the cases, with the first; in 42, or 37 per cent, with the second; in 14, or 12 per cent, with the third; and in five, or 4 per cent, with the fourth vertebra. In the female series studied by Emmons, the curve began in 41.5 per cent of the cases with the first; in 27 per cent with the second; in 22.5 per cent with the third; in 7.4 per cent with the fourth; and in 1.8 per cent with the fifth segment. Among whites, in 224 sacra of five segments examined by the writer, the curve began with the first vertebra in 87 per cent; with the second in 5.4 per cent; and with the third in 7.6 per cent of the cases. It is therefore evident that the anterior curve of the sacrum begins more frequently higher up in the whites than in the Indians. This peculiarity is probably connected with a somewhat greater curvature, even on the average, in the sacrum of whites.

OSSA INNOMINATA AND PELVIS

THE OSSA INNOMINATA

The total number of adult innominate bones of the Munsee, available for examination and measurement, is 37, and in general the bones are remarkable for their regular development, with complete freedom from pathological conditions and from the more important anomalies. They are also of medium dimensions and weight throughout.

The measurements of the bones show that in the paired specimens, in both sexes, they are of nearly the same dimensions on the two sides. The male bones exceed those of the female in both height and breadth, and especially in the former, but relatively to its height the female innominate is broader than that of the male, as a result of which the innominate height-breadth index is higher in the females.

LXVII. MUNSEE; INNOMINATE BONES

MALES

	Right						Left					
	Number of bones	Height maximum (ischio-iliac) (a)	Number of bones	Breadth maximum (of ilium) (b)	Number of cases	Innominate index (b×100) a	Number of bones	Height maximum (a)	Number of bones	Breadth maximum (of ilium) (b)	Number of cases	Innominate index (b×100) a
Average:		cm.		cm.				cm.		cm.		
Pairs...	(5)	21.2	(5)	15.6	(5)	73	(5)	21.2	(5)	15.6	(5)	73.2
All....	(7)	21.2	(6)	15.6	(6)	73.8	(6)	21.3	(5)	15.6	.....	.....
Minimum..	(7)	20.8	(6)	15.1	(6)	70.7	(6)	20.8	(5)	15.2	.....	70.7
Maximum..	(7)	22.2	(6)	16.2	(6)	75.1	(6)	21.8	(5)	16	.....	74.5

FEMALES

Average:												
Pairs...	(11)	20.1	(5)	14.95	(5)	75.6	(11)	20.1	(5)	14.9	(5)	75.1
All....	(11)	20.1	(8)	15.2	(8)	75.9	(13)	20	(10)	14.75	(10)	74.5
Minimum												
(all).....	(11)	18.5	(8)	13.6	(8)	72	(13)	18.5	(10)	13.5	(10)	69.5
Maximum												
(all).....	(11)	20.7	(8)	16	(8)	78.9	(13)	20.8	(10)	15.8	(10)	78

Comparative data on the innominate bones are given in the next table. The Arkansas and Louisiana specimens, as well as those of other Indians, agree closely with those of the Munsee. The innominate of the whites, on the other hand, is both higher and especially broader, hence it shows a higher index in both sexes. Emmons, from his 217 Indian female pelvises, obtained as an average height of the innominate 19.3 cm., and as the breadth 14.5 cm., with a mean index of 74.8. These results agree closely with those of the writer and strengthen the evidence that the innominate bones in the Indians average somewhat smaller in both dimensions, and are also somewhat narrower relatively than those in the whites.

LXVIII. COMPARISON OF THE MUNSEE OSSA INNOMINATA WITH THOSE OF OTHER INDIANS AND OF WHITES

MALES

Group	Right				Left		
	Specimens (pairs)	Height maximum (ischio-iliac)	Breadth maximum	Innominate index	Height maximum (ischio-iliac)	Breadth maximum	Innominate index
		cm.	cm.		cm.	cm.	
Munsee.....	(16)	21.3	15.6	73.4	21.2	15.6	73.2
Arkansas and Louisiana.....	(13)	21.2	15.4	72.7	21.3	15.35	72.1
Southern Utah cliff-dwellers....	(20)	20.5	15.0	73.2	20.5	15	73.3
Southwest and Mexico.....	(12)	20.7	15.2	73.7	20.7	15.2	73.5
United States whites	(32)	22.03	16.43	74.6	22.1	16.47	74.45

LXVIII. COMPARISON OF THE MUNSEE OSSA INNOMINATA WITH THOSE OF OTHER INDIANS AND OF OTHER WHITES—Continued

FEMALES

Group	Right				Left		
	Specimens (pairs)	Height maximum (ischio-ilic)	Breadth maximum	Innominate index	Height maximum (ischio-ilic)	Breadth maximum	Innominate index
Munsee.....	(11)	cm. 20.1	cm. 14.95	75.6	cm. 20.1	cm. 14.9	75.1
Arkansas and Louisiana.....	(8)	19.8	15	75.7	19.95	15.1	76.1
Southern Utah cliff-dwellers.....	(7)	19	14.3	75.4	19.1	14.2	74.6
Southwest and Mexico.....	(12)	19.1	14.6	76.6	19.2	14.75	76.8
United States whites.....	(20)	20.2	15.73	77.9	20.1	15.7	78.1

THE PELVIS AS A WHOLE

The Munsee pelvis available for measurement comprise those of six males and ten females. They are free from all deformation, and present the usual sexual characteristics with regard to massiveness, the flare of the ilia, the subpubic angle, and the width of the great sciatic notch.

The articulated pelvis, with a slight space left for the pubic cartilage, gave measurements shown in the table below. The male pelvis, it is seen, is somewhat larger than the female in both of its mean external dimensions, and is also somewhat higher relatively, as a result of which it shows a higher height-breadth index.

LXIX. MUNSEE: PELVIS AS A WHOLE

MALE

	Number	Mean height of ossa innominata	Breadth maximum of pelvis	Pelvic index*	Superior Strait		
					Breadth maximum (a)	Diameter† antero-posterior (b)	Brim index $\frac{b \times 100}{a}$
		cm.	cm.		cm.	cm.	
Average.....	(6)	21.2	26.7	78.9	12.1	10.6	87.8
Minimum.....	(6)	20.8	24.4	76.6	11.6	9.6	78.7
Maximum.....	(6)	21.5	28.2	85.9	12.8	11.2	98.3

FEMALE

Average.....	(10)	19.95	25.9	77.0	13.0	11.0	84.5
Minimum.....	(10)	18.5	24.1	73.3	12.3	9.4	70.7
Maximum.....	(10)	20.7	27.8	80.4	13.8	12.5	94.4

* Mean height of innominate bones $\times 100$
maximum breadth of pelvis

† Promontory of sacrum to nearest point on the inner lip of pubic bones.

The pelvic cavity at the superior strait or brim is more spacious, both antero-posteriorly and laterally, in the Munsee female than in the male, and it is also somewhat broader relatively to its depth, as a result of which it gives a somewhat lower depth-breadth index.

On comparison with the pelvises of the mound-building Indians of the Arkansas and Louisiana mounds, those of the Southwest and Mexico, and those of United States whites, it is seen that the Munsee pelvis, as a whole, is of moderate dimensions, especially in its breadth, which is slightly smaller than that in any of the other groups in the males and in most of the females. Because of this fact, the height-breadth index of the pelvis in the Munsee is relatively high—higher than that of any of the other Indians. It is exceeded in this respect only by the pelvis of the white males.

An even more marked peculiarity of the Munsee pelvis applies to its inlet or brim. As will be seen by a glance at the figures, this is relatively narrow and deep in both sexes; the lateral diameter, with a single minor exception, is the lowest, and the diameter antero-posterior the highest of all the groups. As a result of this condition, the brim index of the Munsee in both males and females is exceptionally high.

LXX. COMPARISON OF THE MUNSEE PELVIS WITH THAT OF OTHER INDIANS AND OF WHITES

MALES

Group	Specimens (pairs)	Mean height of ossa innominata	Greatest breadth of pelvis (between outer lips of crests)*	Pelvic index	Diameter lateral maximum of brim	Diameter antero-posterior maximum of brim	Brim index
		<i>cm.</i>	<i>cm.</i>		<i>cm.</i>	<i>cm.</i>	
Munsee.....	(6)	21.2	26.7	78.9	12.1	10.6	87.8
Arkansas and Louisiana	(23)	21.55	28.1	76.7	13	10.4	79.8
Southern Utah cliff-dwellers.....	(23)	20.6	26.85	76.7	12.4	10	80.6
Southwest and Mexico..	(15)	20.6	27	76.2	12.3	9.7	78.7
United States whites...	(32)	22.06	27.1	81.4	12.7	9.64	75.9

FEMALES

Munsee.....	(10)	19.95	25.9	77.0	13	11	84.5
Arkansas and Louisiana	(12)	19.7	26.8	73.5	13.33	10.74	81.4
Southern Utah cliff-dwellers.....	(7)	19.05	25.4	74.5	13.1	10.1	77.4
Southwest and Mexico..	(12)	19.15	25.7	74.4	12.9	10.75	83.1
United States whites...	(20)	20.16	27.05	74.5	13.35	10.73	80.4

*The pelvis being held in articulation.

The brim index in general shows unexpected irregularity from group to group and between the two sexes. In the Munsee and the

southern Utah cliff-dwellers it is higher in the males; in the other Indians and in the whites it is higher in the females; and the range of its groupal as well as individual variation is considerable. As all the specimens were measured by the author with the same instruments, by the same method, and with equal care, the differences can not be attributed to error, hence the only reasonable conclusion is that even under normal conditions (for these series contain no deformed or pathological pelves) the absolute as well as the relative dimensions of the superior strait are capable of not a little fluctuation, attributable, it seems, in some measure at least, to an early unequal development of the soft parts both within and without the pelvic cavity.

In order to satisfy himself further on this point, the writer extracted a number of the larger series of pelvic measurements from Emmons's data, and from the next table it will be seen that, although they relate to females only, the groupal variation is also marked. Yet these differences among the Indians rarely if ever fall below what may be considered normal limits, or such a limit as would in the female still permit of safe childbirth under other normal conditions. They are therefore what may be called *infunktional* or *transfunktional* fluctuations.

LXXI. FEMALE INDIAN PELVIS: SUPERIOR STRAIT*

Group	Specimens	Diameter antero-posterior	Diameter lateral	Index
		<i>cm.</i>	<i>cm.</i>	
Northwest coast.....	(31)	12.99	10.7	82.39
California.....	(16)	13.2	10.56	80
Sioux.....	(12)	13.03	10.98	84.26
Tennessee.....	(6)	13.32	10.93	82.01
Kentucky.....	(8)	13.09	10.66	81.42
New Mexico.....	(10)	13.26	10.43	78.65
Arizona.....	(57)	12.87	9.52	74.01
Mexico.....	(15)	12.71	10.93	85.55
Peru.....	(13)	12.71	10.12	79.58

*Emmons's series.

SHORT AND OTHER BONES

PATELLA

The patella, the largest of the sesamoid bones, offers three dimensions for measurements, namely, the maximum height, the maximum breadth, and the maximum thickness; and the mean of these diameters, the *patellar module*, is a convenient unit for comparing the size of the bone.

The 30 patellæ present in the Munsee collection give proportions which are tabulated below. The male bone is perceptibly larger in all dimensions than the female. There are but small differences as

to side, and they are probably due in a measure, if not entirely, to the small number of specimens. The mean diameter or module is practically the same on both sides in both the male and the female. The breadth-height index averages slightly over 100 and offers nothing definitely distinctive either as to sex or to side. It varies in males from 91.7 to 107.4, in the females from 93.8 to 107.9.

LXXII. MUNSEE: PATELLÆ

* MALES

	Right							
	Number	Height, maximum	Number	Breadth, maximum	Number	Thickness, maximum	Number	Breadth-height index
Average:	(4)	<i>cm.</i> 4.5	(4)	<i>cm.</i> 4.6	(4)	<i>cm.</i> 2.11	(4)	102.8
Pair	(6)	4.41	(6)	4.57	(6)	2.06	(6)	103.6
All	(6)	4.2	(6)	4.4	(6)	1.95	(6)	97.8
Minimum (all)	(6)	4.6	(6)	4.8	(6)	2.3	(6)	105.9
Maximum (all)								
	Left							
	Number	Height, maximum	Number	Breadth, maximum	Number	Thickness, maximum	Number	Breadth-height index
Average:	(4)	4.6	(4)	4.55	(4)	2.1	(4)	98.9
Pairs	(10)	4.36	(11)	4.38	(12)	2.04	(10)	100.5
All	(10)	4	(11)	3.9	(12)	1.85	(10)	91.7
Minimum (all)	(10)	4.8	(11)	4.7	(12)	2.25	(10)	107.4
Maximum (all)								

FEMALES

	Right							
	Number	Height, maximum	Number	Breadth, maximum	Number	Thickness, maximum	Number	Breadth-height index
Average:	(5)	<i>cm.</i> 3.93	(5)	<i>cm.</i> 4.02	(8)	<i>cm.</i> 1.73	(5)	102.3
Pairs	(9)	3.93	(9)	3.97	(11)	1.75	(9)	100.4
All	(9)	3.7	(9)	3.7	(11)	1.5	(9)	93.8
Minimum (all)	(9)	4.1	(9)	4.3	(11)	1.9	(9)	107.9
Maximum (all)								
	Left							
	Number	Height, maximum	Number	Breadth, maximum	Number	Thickness, maximum	Number	Breadth-height index
Average:	(5)	3.93	(5)	4.05	(8)	1.76	(5)	103.1
Pairs	(5)	3.95	(5)	4.05	(8)	1.76	(5)	103.1
All	(5)	3.8	(5)	3.85	(8)	1.5	(5)	96.2
Minimum (all)	(5)	4.05	(5)	4.1	(8)	1.95	(5)	107.9
Maximum (all)								

Module (mean diameter)—Males: right, 3.74; left, 3.75; females: right, 3.23; left, 3.25.

A comparison of the Munsee patella with that of whites shows that the latter is slightly larger in both sexes and on both sides; its relative proportions, however, are very much the same, except that the bone in white males on both sides appears to be relatively

slightly higher than in the females, which, while also true of the Munsee on the right side, does not hold true for the left.

LXXIII. PATELLÆ: MUNSEE AND WHITES

MALES

Group	Specimens (pairs)	Right				Left			
		Height	Breadth	Thickness	Breadth-height index	Height	Breadth	Thickness	Breadth-height index
		cm.	cm.	cm.		cm.	cm.	cm.	
Munsee.....	(8)	4.5	4.6	2.11	102.8	4.6	4.55	2.1	98.9
United States whites.	*(200)	4.56	4.64	2.15	101.7	4.52	4.66	2.17	103.2

Module (mean diameter)—Males: Munsee, right, 3.74; left, 3.75; whites, right, 3.78; left, 3.78.

FEMALES

Munsee.....	(10)	3.93	4.02	1.73	102.3	3.93	4.05	1.76	103.1
United States whites.	*(100)	4.02	4.03	1.9	100.2	3.97	4.08	1.9	102.7

Module—Females: Munsee, right, 3.23; left, 3.25; whites, right, 3.32; left, 3.32.

* Males: 100 right, 100 left; females: 50 right, 50 left patellæ.

The Munsee patella, while in general slightly smaller than that of the whites, will be seen from the comparative data in the accompanying table to average somewhat larger than that of other Indians available for comparison. The larger size in all dimensions of the white man's patella than that of the Indian is doubtless due to the greater muscularity of the white subjects from which the bones were derived and who belonged almost exclusively to the laboring classes.

Of the 30 Munsee patellæ, 15 show a moderate to well developed semilunar notch in the lateral border of the bone, for the *vastus lateralis* (pl.28, b). The patellæ of female skeleton no. 285,311 are decidedly oblique, especially that on the left side; and the patellæ of female no. 285321 show each an exceptionally long apex.

LXXIV. THE MODULE OR MEAN DIAMETER OF THE PATELLA IN THE MUNSEE AND OTHER GROUPS

Group	Male		Female	
	Right	Left	Right	Left
	cm.	cm.	cm.	cm.
Munsee.....	3.74	3.75	3.23	3.25
Arkansas and Louisiana.....	3.54	3.50	3.17	3.17
Southern Utah cliff-dwellers.....	3.61	3.58	3	3
Southwest and Mexico.....	3.49	3.49	.....	.....
United States whites	3.78	3.78	3.32	3.32

BONES OF THE HAND

While the total number of bones of the hands in the Munsee material aggregate nearly 700, there are very few complete sets. It is nevertheless possible to ascertain that in general the hand of the Munsee was of moderate to medium development, and remarkably normal in conformation. Among the females, some of the bones are quite small. The only anomaly worthy of mention is the presence of rudimentary hamuli on both unciforms in one of the male subjects (no. 285,308).

The proportional length of the hand can be judged from the measurements of the first metacarpal, and from the relation of this length to that of the humerus on the same side. The following table gives these dimensions. It is seen that the length of the first metacarpal in the male exceeds somewhat that of the female, and also that the length of the right bone exceeds slightly that of the left. The metacarpo-humeral index is somewhat higher on the right in the males, indicating a somewhat greater length of the hand on the right side in that sex. In the females the small number of specimens makes the result in this respect uncertain.

LXXV. MUNSEE: FIRST METACARPAL

MALES

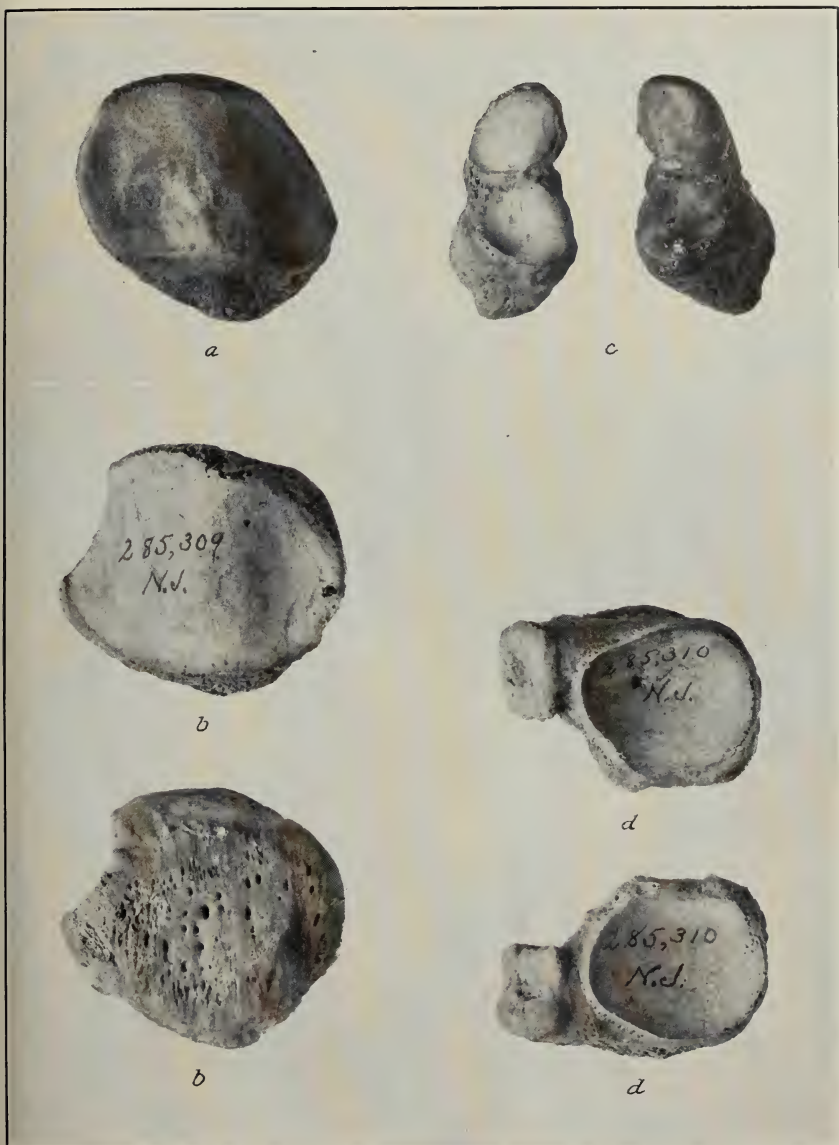
	Right			Left		
	Number of specimens	Length, maximum	*Metacarpo-humeral index $\frac{mc \times 100}{H}$	Number of specimens	Length, maximum	Metacarpo-humeral index
Average:		cm.			cm.	
Pairs.....	(5)	4.6	14.5	(5)	4.5	14.1
Total present.....	(8)	4.7	14.5	(5)	4.5	14.1
Minimum (total present).....	(8)	4.2	12.9	(5)	4.25	12.9
Maximum (total present).....	(8)	5.1	16.2	(5)	4.8	15

FEMALES

Average:						
Pairs.....	(5)	4.3	14	(5)	4.3	14.3
Total present.....	(8)	4.4	14.3	(7)	4.2	13.9
Minimum (total present).....	(8)	3.9	13.2	(7)	3.75	12.8
Maximum (total present).....	(8)	4.8	15.3	(7)	4.8	15.8

* $\frac{\text{Maximum length of first metacarpal} \times 100}{\text{Maximum length of humerus.}}$

A comparison of the first metacarpal in the Munsee and in the United States whites shows that this bone in the Munsee on both sides (and in both sexes) is somewhat shorter, indicating a smaller



- a* PATELLA OF FEMALE MUNSEE SKELETON NO. 285,311, U.S.N.M.,
SHOWING MARKED OBLIQUITY
- b* PATELLÆ OF FEMALE MUNSEE SKELETON NO. 285,309, U.S.N.M.,
SHOWING PRONOUNCED VASTUS NOTCH
- c* INTERNAL CUNEIFORM OF MALE MUNSEE SKELETON NO. 285,301,
U.S.N.M., SHOWING EACH A DOUBLE METATARSAL FACET
- d* PAIR OF FEMALE MUNSEE SCAPHOIDS SHOWING UNUSUAL BROAD
TALUS FACET AND PECULIAR TUBEROSITY

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hand. This is also apparent in the metacarpo-humeral index, which on both sides in the whites is higher than in the Munsee. The absolute and relative smallness of the Indian hand, particularly in the males and on the right side, is doubtless due to its lesser use.

LXXVI. FIRST METACARPAL IN MUNSEE AND IN WHITES

Both sexes	Specimens	Length, maximum	Metacarpo- humeral index	Specimens	Length, maximum	Metacarpo- humeral index
		<i>cm.</i>			<i>cm.</i>	
Munsee.....	(16)	4.55	14.4	(12)	4.35	14.0
United States whites.....	(94)	4.69	14.9	(65)	4.43	14.3

BONES OF THE FEET

Owing to their larger size and greater differentiation, a number of the bones of the feet, particularly of the tarsus, yield material for measurement and special observation, and have received rather extended attention by anatomists and anthropologists,¹ but as yet there is no perfect uniformity in the methods of measurement or of description. The writer's object in selecting his measurements and points for description was to employ only those that appear to be the most sensible and significant, the most readily standardized, and involving no details, save in cases that may be of special importance.

First Metatarsal

As the first metacarpal serves in a measure as an index of the size of the hand, so the first metatarsal gives an indication of that of the foot. The proportional length of the foot can further be judged from the percental relation of the first metatarsal to the femur. The relation between the size of the feet and that of the hands is expressed by the pollex-hallux index, or percental relation between the first metacarpal and the first metatarsal.

There are in all 36 first metatarsals among the Munsee bones, the measurements and relations of which are given in the above table. It will be seen that the length of the bone is, on the average, greater in the males than in the females, but it does not differ perceptibly on the two sides of the body in either sex.

The hallux-femur index is practically equal on the two sides (differing only in centesimals), and is larger in the males than in the females, showing that the foot of the Munsee male was not only somewhat larger than that of the female, but was also larger

¹ S. P. Lazarus, Zur Morphologie des Fufsskelettes, *Morphol. Jahrb.*, XXIV, H. 1, repr., 8°, Leipzig, 1896; W. Pfitzner, Beiträge zur Kenntniss des menschlichen Extremitätenskelets, *Morphol. Arbeiten*, I, H. 1, Jena, 1891; Th. Volkov, Variations squelettiques du pied chez les primates et dans les races humaines; Thèse doctorale de la Faculté des Sciences, Paris, 1905; Chas. Fraipont, L'Astragale de l'homme Moustérien, etc., 8°, Bruxelles, 1912; M. Reicher, Beitrag zur Anthropologie des Calcaneus, *Archiv für Anthropologie*, N. F., XII, H. 2, 1913; S. Poniatowski, Badania Antropologiczne nad Kóscia Skokowa (Anthropological Studies of the Talus), *Prace Towarzystwa Naukowego Warszawskiego*, 1913.

in that sex in relation to the length of the femur and the stature. This relative excess of the foot is more marked than was that of the hand, and in all probability is a result of greater functional activity, the male Indians being excessive walkers and runners.

A comparison of the first metatarsal in the Munsee and in the United States whites shows that in the latter, in both sexes, the bone is longer, indicating, on the average, a longer foot. The difference is especially marked on the left side and is probably both racial and functional.

As a result of the greater length of the bone in the United States whites, whose average stature is very nearly that of the Munsee, we find that their hallux-femur index is decidedly higher than that of the Munsee, especially on the left side. The white man's foot is therefore not only longer absolutely, but also relatively as compared with the femur and, indirectly, the stature.

The foot of the whites is also somewhat longer relatively to the hand, than that of the Munsee, and especially on the left side, which gives us a lower pollex-hallux index for the whites.

LXXVII. MUNSEE: FIRST METATARSAL

MALES

	Right						Left					
	Number of specimens	Length, maximum	Number of cases	Pollex-hallux index *	Number of cases	Metatarso-femoral index †	Number of specimens	Length, maximum	Number of cases	Pollex-hallux index	Number of cases	Metatarso-femoral index
Average:		cm.						cm.				
Pairs.....	(6)	6.5	(4)	70.4	(5)	14.7	(6)	6.5	(4)	69.2	(5)	14.7
Total present.	(11)	6.5	(8)	72.4	(9)	14.5	(8)	6.48	(4)	69.2	(7)	14.2
Minimum (total present).....	(11)	6.1	(8)	65.1	(9)	13.8	(8)	6.3	(4)	65.4	(7)	12.9
Maximum (total present).....	(11)	6.8	(8)	76.6	(9)	15.1	(8)	6.8	(4)	71.1	(7)	15.2

FEMALES

Average:												
Pairs.....	(7)	6.0	(4)	73.2	(6)	14.2	(7)	6.0	(4)	73.9	(6)	14.2
Total present.	(8)	5.97	(7)	72.2	(7)	14.1	(9)	5.91	(6)	72.4	(7)	14.1
Minimum (total present).....	(8)	5.5	(7)	70.9	(7)	13.5	(9)	5.45	(6)	67	(7)	13.5
Maximum (total present).....	(8)	6.45	(7)	75.4	(7)	15.1	(9)	6.4	(6)	77.4	(7)	15.2

*Maximum length of first metacarpal×100
Maximum length of first metatarsal.

† Maximum length of first metatarsal×100
Bicondylar length of femur.

LXXVIII. THE FIRST METATARSAL IN THE MUNSEE AND IN UNITED STATES WHITES

Both sexes	Right				Left			
	Specimens	Length, maximum	Hallux-femur index	Pollex-hallux index	Specimens	Length, maximum	Hallux-femur index	Pollex-hallux index
Munsee.....	(19)	cm. 6.3	14.3	72.3	(17)	cm. 6.2	14.15	71.1
United States whites*....	(51)	6.6	15.3	71.1	(33)	6.7	15.5	66.1

* The indexes in whites are close approximations.

Os Calcis

Being the largest bone of the tarsus, and the most important functionally, the os calcis, or calcaneus, seems to deserve closer attention by anthropologists than it usually receives.

The bone presents three different and fairly easily ascertainable dimensions: (1) the greatest length of the whole bone; (2) the minimum breadth or thickness of the body; and (3) the height of the body at its greatest constriction. It further offers several interesting points for visual observation.

The total number of calcanei in the Munsee material is 51, which gives a fair male and female series. The following table shows the measurements on 40 of those that are paired and hence most suitable for comparison.

LXXIX. MUNSEE BONES: OS CALCIS

MALES

	Specimens (pairs)	Length, maximum	Breadth, minimum of body *	Height of body †	Breadth-length index	Breadth-height index
		cm.	cm.	cm.		
Average.....	{ 10	8.1	2.74	4.07	33.9	67.4
	{ 10	8.05	2.72	4.07	33.87	66.9
Minimum.....	{ 10	7.7	2.5	3.7	30.1	61.6
	{ 10	7.5	2.45	3.8	28.1	62.2
Maximum.....	{ 10	8.5	3	4.5	37.7	72.5
	{ 10	8.5	3	4.5	37.3	73.7

FEMALES

Average.....	{ 10	7.35	2.4	3.6	32.9	66.9
	{ 12	7.3	2.38	3.6	33.1	66.4
Minimum.....	{ 10	6.7	2	3.2	28.2	60.6
	{ 12	6.7	1.95	3.3	28.7	59
Maximum.....	{ 10	7.7	2.65	3.8	34.7	71.6
	{ 12	7.8	2.65	3.9	34.3	70.4

* Branches of *compas glissière* applied to the sides of the bone in the region of minimum thickness of the body.

† Maximum height at greatest constriction of body, obtained by moving the bone from side to side between the points of the branches of the *compas glissière*.

It will be observed that, as is usual with other parts of the skeleton, the male bone is somewhat larger than the female; also that the right os calcis averages very slightly larger than the left in length and breadth, but is equal in both sexes to that of the left side in height. Reducing the three average measurements to a mean diameter, or module, we obtain for the males on the right, 4.97 cm.; on the left, 4.95 cm.; for the females, right, 4.45 cm.; left, 4.43 cm. showing that the difference in the mass of the bones on the two sides is very small.

The three measurements of the os calcis give rise to two indexes: one expressing the percental relation between its breadth and length, the other showing a similar relation between its breadth and height. The breadth-length index is somewhat higher in the males than in the females, but in the paired bones does not differ very appreciably on the two sides. Taking all the bones, as in the next table, we see that the index in the males predominates slightly over that in the females, which, judging from the constancy of the condition in the several series of specimens used for comparison, is probably also the true condition in the Munsee. It indicates a tendency in the males toward not only absolutely but also relatively slightly thicker calcaneus.

The breadth-height index, like the breadth-length proportion, is also slightly higher on both sides in the males than in the females, and in both sexes on the right than on the left side. As the height is the same on the two sides, this shows exactly the slightly greater relative thickness of the bone in the males than in the females, and on the right than on the left side. The phenomenon is doubtless connected with difference of stress to which the bone is subjected in the two sexes and on the two sides of the body.

The comparative data given in the following table show that, as with many other bones of the body, the os calcis in the Munsee and in other Indians in both sexes, and especially in the males, is smaller in all dimensions than it is in the whites. The relative proportions of the bone are quite alike in the different racial groups of males, but differ in an interesting way in the females, in which, among the whites, the bones show lower indexes than in the other groups. The white female os calcis is longer and higher, but equal in slenderness to that of the Indian.

LXXX. OS CALCIS: COMPARISON

MALES

Group	Number of specimens	Length, maximum	Breadth, minimum of body	Height, minimum of body	Module	Breadth-length index	Breadth-height index
		cm.	cm.	cm.	cm.		
Munsee.....	(29)	8.07	2.77	4.04	4.76	34.1	67.9
Arkansas and Louisiana.....	(34)	8	2.75	3.97	4.91	34.5	69.3
Southern Utah cliff-dwellers....	(50)	7.72	2.81	4.05	4.86	36.4	69.4
Southwest and Mexico.....	(16)	7.85	2.67	4.01	4.84	34	66.5
United States whites.....	(55)	8.33	2.85	4.20	5.13	34.1	67.7

FEMALES

Munsee.....	(22)	7.3	2.4	3.6	4.43	32.6	66.2
Arkansas and Louisiana.....	(12)	7.3	2.45	3.5	4.42	33.7	70.3
Southern Utah cliff-dwellers....	(30)	6.92	2.43	3.56	4.30	35.1	68.3
Southwest and Mexico.....	(13)	7.1	2.4	3.43	4.31	33.8	70.1
United States whites.....	(30)	7.87	2.43	3.81	4.71	30.9	63.7

Articular Facets for Astragalus

As to visual observations on the os calcis, the greatest interest attaches probably to the number and conformation of the articular facets for the astragalus. These facets may be two in number, anterior and posterior. But the anterior facet may be divided into two by a ridge; or it may be replaced by two facets, anterior and median, completely separated by a narrow to moderately broad groove or space; or, finally, in place of the single oblong anterior facet there may be a small to rudimentary anterior and a medium sized median facet, separated by a broad and deep notch.

The percental distribution of these facets among the Munsee, the Arkansas and Louisiana mound Indians, and the United States whites, is given below. There is a remarkable similarity in the frequency of occurrence of the two main forms (two and three facets) in all three groups among the males, but the females show slight irregularity.

LXXXI. OS CALCIS: MUNSEE AND COMPARATIVE: ARTICULAR FACETS FOR ASTRAGALUS

Group	Male			Female		
	Specimens	Two facets	Three facets	Specimens	Two facets	Three facets
		Per cent	Per cent		Per cent	Per cent
Munsee.....	(31)	26	74	19	48	52
Arkansas and Louisiana.....	(39)	26	74	33	37	63
United States whites.....	(55)	25.5	74.5	30	40	60

The agreement above set forth might lead us to suppose that practically no racial differences are connected with the facets, at least between the whites and some of the Indians; but this assumption is not borne out by a detailed study of these characters. The next table shows the more detailed observations on the number and character of these facets in the Munsee and in whites, and also with reference to sex and side. Here we notice, in the first place, that the frequency of two facets only is much higher in both groups in the females than in the males, while three facets are correspondingly more frequent in the males. But we observe further that the condition of three facets in which the anterior and median are separated by a wide notch is very much more frequent among the whites than among the Indians.

As to sides, differences between the right and left are irregular; if we combine the two series of Munsee and whites they almost disappear.

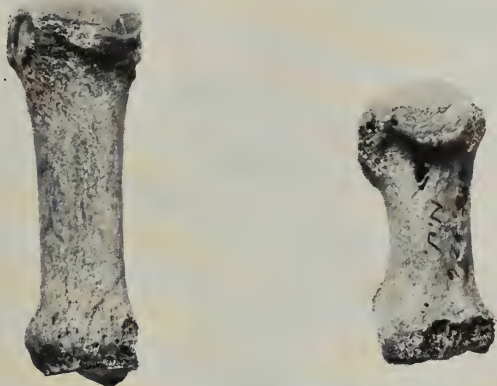
LXXXII. OSCALCIS IN THE MUNSEE AND IN UNITED STATES WHITES: ARTICULAR FACETS FOR ASTRAGALUS

	Specimens	Two facets	Three facets, but the two anterior separated only by a ridge	Three facets completely disconnected	Three facets, disconnected, with a wide notch between the anterior two
Males:		<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
Munsee.....	(31)	25.8	19.4	35.5	19.4
United States whites.....	(55)	25.5	7.3	29.1	38.2
Females:					
Munsee.....	(29)	48.3	10.3	41.4	.....
United States whites..	(30)	40	16.7	20	23.3
Right:					
Munsee.....	(31)	42	6.5	42	9.7
United States whites.....	(51)	29.4	15.7	21.6	33.3
Left:					
Munsee.....	(29)	31	24	34.5	10.3
United States whites.....	(34)	32.4	2.9	32.4	32.4

An additional point of some interest in connection with the calcaneus is the development of the peroneal spine. Among the Munsee this was found frequently to be very moderate and never pronounced; among the whites, cases with a much more marked development of the spine are met with occasionally, especially among the males.

Astragalus

Next to the calcaneus, the most interesting bone of the tarsus is the astragalus. The bone exhibits wide and characteristic variations



a THE RIGHT AND LEFT FIRST METATARSAL OF MUNSEE SKELETON NO. 285,326, U.S.N.M., SHOWING DISPROPORTION IN SIZE; ALSO A CANAL IN THE SMALLER BONE, POSSIBLY THE VESTIGE OF AN EARLY FRACTURE



b THE CALCANEI OF MALE MUNSEE SKELETON NO. 285,313, U.S.N.M., SHOWING WIDE SEPARATION OF THE TWO FACETS FOR THE ASTRAGALUS

among the higher mammals and may well be expected to show some groupal differences in man. It yields itself to three measurements, the maximum length, breadth, and height, from which in turn we obtain the module or mean diameter, useful in comparing the size of the bone, and the breadth-length and breadth-height indexes, which show its shape.

There are 60 astragali in the Munsee material, and the measurements of 52 paired bones are given below. They show the bone in the male to be absolutely larger in every dimension than in the female. As to the side, there is practically no difference among the males, but among the females the average measurements of the left astragalus are all slightly higher than those of the right bone. The module is practically identical on the two sides in the males, and slightly higher

LXXXIII. MUNSEE: ASTRAGALUS

MALES

	Right						
	Specimens (pairs)	Length, maximum*	Breadth, maximum†	Height, maximum‡	Module	Breadth-length index	Height-length index
		<i>cm.</i>	<i>cm.</i>	<i>cm.</i>	<i>cm.</i>		
Average.....	(12)	5.7	4.27	3.27	4.41	74.9	57.4
Minimum.....		5.3	4.1	3.05	4.41	70.7	54.7
Maximum.....		6.2	4.6	3.5	4.41	83.3	62.5

	Left					
	Length, maximum	Breadth, maximum	Height, maximum	Module (mean diameter)	Breadth-length index	Height-length index
	<i>cm.</i>	<i>cm.</i>	<i>cm.</i>	<i>cm.</i>		
Average.....	5.7	4.28	3.25	4.41	75.1	57.1
Minimum.....	5.3	4.05	3.05	-----	72.3	53.8
Maximum.....	6.3	4.7	3.5	-----	79.2	60.7

FEMALES

	Right						
	Specimens (pairs)	Length, maximum*	Breadth, maximum†	Height, maximum‡	Module	Breadth-length index	Height-length index
		<i>cm.</i>	<i>cm.</i>	<i>cm.</i>	<i>cm.</i>		
Average.....	(14)	5.19	3.9	3	4.02	75	57.8
Minimum.....		4.7	3.5	2.7	4.02	70.5	54.4
Maximum.....		5.7	4.1	3.3	4.02	83.7	62.3

* Stem of calipers applied to lowest (most prominent) parts on medial surface of the bone.

† Distal branch of calipers applied to lowest (most prominent) parts on medial surface of the bone.

‡ On osteometric plane (Broca), all three lowest points of inferior surface of the bone touching the vertical board while the square is applied to the most prominent part of the bone from the opposite direction.

LXXXIII. MUNSEE: ASTRAGALUS—Continued

FEMALES

	Left					
	Length, maximum	Breadth, maximum	Height, maximum	Module (mean di- ameter)	Breadth- length index	Height- length index
Average	<i>cm.</i> 5.22	<i>cm.</i> 3.93	<i>cm.</i> 3.03	<i>cm.</i> 4.06	75.2	58
Minimum	4.8	3.6	2.7	.....	69.9	52.8
Maximum	5.7	4.15	3.4	.....	83.7	61.5

on the left in the females. As to the relative proportions, there is great similarity between the two sexes, as well as on the two sides of the body.

The results presented in this table would not be wholly satisfactory without the possibility of comparing them with similar observations, obtained by the same methods, on the bones of the whites. Such comparative data, furnished in the next table, show a number of points of considerable interest. In the first place, as with the calcaneus and other parts of the skeleton, the Munsee bones are seen throughout to be of more moderate dimensions than the bones of the whites. The module in the latter is very perceptibly higher.

There are, however, also notable differences in the relative proportions of the bones in the two races. Among the whites in both sexes the astragalus is relatively longer and also higher than it is among the Indians, as a result of which both of the indices of the bone in the whites are lower. The differences in this respect are too large and regular to be accidental.

LXXXIV. ASTRAGALUS IN THE MUNSEE AND IN UNITED STATES WHITES

MALES

Group	Specimens	Length, maximum	Breadth, maximum	Height, maximum	Module	Breadth- length index	Height- length index
		<i>cm.</i>	<i>cm.</i>	<i>cm.</i>	<i>cm.</i>		
Munsee.....	(24)	5.7	4.28	3.26	4.42	75.0	57.2
United States whites	(50)	6.29	4.48	3.32	4.7	71.2	52.8

FEMALES

Munsee.....	(28)	5.2	3.91	3	4.04	75.1	57.9
United States whites	(33)	5.75	4.02	3.11	4.29	69.8	54

In the examination of the os calcis, special attention was directed to its facets, especially the middle and anterior, for the astragalus. Inspection of the corresponding facets on the astragalus shows that these do not harmonize fully with those of the os calcis. They are less differentiated and more frequently connected or fused. Thus we have among 60 Munsee astragali, 28, or approximately 47 per cent

which show only one facet corresponding to the anterior and middle facets of the calcaneus, without any dividing line; 29, or 48 per cent, with one facet divided more or less completely by a ridge; and only three specimens, or 5 per cent, in which there are two distinct facets, though in but one of these are they separated by a moderate space. In the astragalus of the whites the proportions of these different forms are by no means the same as in the Munsee. Thus among 82 bones there are but 24, or 29 per cent, with one facet not divided by any ridge; 35, or 43 per cent, with one facet divided by a ridge; and no fewer than 23, or 28 per cent, of those in which there are two distinct facets, in 19 of which they are completely separated by a narrow to moderate space. The frequency of two facets well separated is therefore much greater among the whites than among the Munsee, which is another interesting distinction in the astragalus of these two groups and possibly of the two races which they represent. This is the more remarkable as no corresponding difference has been found in the facets on the os calcis.

Scaphoid

There are three additional bones of the tarsus which deserve somewhat detailed scrutiny, namely, the scaphoid or navicular, the cuboid, and the internal cuneiform. Although irregular in shape, each one of these bones yields to three measurements, which differ in the two sexes as well as racially, and each presents a number of points for observation.

The measurements taken by the writer on the scaphoid as well as on the other tarsal bones are, it may be repeated, the most practicable ones, and relate as closely as possible to the three principal dimensions of the specimens. In the case of the scaphoid they are the greatest breadth, height, and stoutness.

The results of the measurements of the scaphoid in the Munsee appear in the next table. The bone in the male is very perceptibly larger than that in the female, and that of the right foot is in both sexes and in all dimensions somewhat larger than that of the left. These conditions are shown nicely by the module or mean diameter of the bone.

The three measurements give rise to two indexes, which indicate the relative proportions of the scaphoid. The height-breadth index is somewhat larger on both sides in the females than in the males, which, as will readily be seen by reference to the actual dimensions, is due to the relatively greater breadth of the Munsee scaphoid in the males. No special difference is observable on the two sides of the body in the males, but in the females the right bone is relatively higher than the left.

The stoutness-breadth index offers no special differences either on the two sides or in the two sexes.

LXXXV. MUNSEE: SCAPHOID

MALES

	Right						
	Number of specimens, pairs	Breadth,* maximum	Height,† maximum	Stoutness,‡ maximum	Module (mean diameter)	Height-breadth index	Stoutness-breadth index
		<i>cm.</i>	<i>cm.</i>	<i>cm.</i>	<i>cm.</i>		
Average	(6)	4.20	2.11	2.61	2.98	50.2	62.3
Minimum		3.9	1.9	2.5	2.66	48.4	62.2
Maximum		4.55	2.2	2.85	3.2	55.4	64.1

	Left						
	Number of specimens	Breadth	Height	Stoutness	Module (mean diameter)	Height-breadth index	Stoutness-breadth index
		<i>cm.</i>	<i>cm.</i>	<i>cm.</i>	<i>cm.</i>		
Average	(6)	4.05	2.04	2.55	2.88	50.4	63
Minimum		3.65	1.7	2.45	2.6	46.6	60.5
Maximum		4.5	2.25	2.75	3.16	53.7	67.1

FEMALES

	Right						
	Number of specimens, pairs	Breadth,* maximum	Height,† maximum	Stoutness,‡ maximum	Module (mean diameter)	Height-breadth index	Stoutness-breadth index
		<i>cm.</i>	<i>cm.</i>	<i>cm.</i>	<i>cm.</i>		
Average	(6)	3.75	1.96	2.35	2.69	52.2	62.7
Minimum		3.5	1.75	2.25	2.59	48.1	60
Maximum		4.05	2.15	2.5	2.85	56.1	66.7

	Left						
	Number of specimens	Breadth	Height	Stoutness	Module (mean diameter)	Height-breadth index	Stoutness-breadth index
		<i>cm.</i>	<i>cm.</i>	<i>cm.</i>	<i>cm.</i>		
Average	(6)	3.72	1.89	2.31	2.64	50.8	62.2
Minimum		3.4	1.7	2.15	2.43	45.7	50.8
Maximum		4.05	2.05	2.45	2.97	55.4	68

* From the extremity of the tuberosity ad maximum.

† Use calipers with broad branches; hold instrument vertical; lay bone on movable branch on talus facet and raise the branch until the bone touches the under surface of the immovable branch.

‡ Same instrument as for last; lay bone on movable branch on its dorsal or superior surface; let it assume a natural position and raise the branch until the most prominent part of the plantar surface of the bone touches the under surface of the movable branch.

A comparison of the measurements of the Munsee scaphoid with those obtained on the United States whites shows a number of interesting conditions. The bone in the whites is again in both sexes and in all dimensions somewhat larger than in the Indian. The height-breadth index is identical in the females of the two races, but is more elevated, owing to a relatively greater height of the bone, in the white than in the Munsee males. The stoutness-breadth index is decidedly higher in both sexes in the whites, though more particularly so in the males. It may therefore be stated that the scaphoid in the United States whites is, in both sexes, not only absolutely but also relatively stouter, and in the males also relatively somewhat higher, than that in the Munsee Indians.

LXXXVI. SCAPHOID IN MUNSEE AND IN UNITED STATES WHITES

MALES

	Number of specimens	Breadth	Height	Stoutness	Module	Height-breadth index	Stoutness-breadth index
		<i>cm.</i>	<i>cm.</i>	<i>cm.</i>	<i>cm.</i>		
Munsee	(19)	4.13	2.08	2.59	2.93	50.4	62.8
United States whites.....	(52)	4.33	2.23	2.96	3.17	51.5	68.5

FEMALES

Munsee.....	(19)	3.75	1.94	2.35	2.68	51.7	62.7
United States whites.....	(36)	3.94	2.03	2.54	2.84	51.6	64.3

An inspection of the Munsee scaphoid shows a number of interesting particulars. A facet for the cuboid is present in only 23.5 per cent of the cases (15 per cent males and 30 per cent females); among the United States whites its frequency is nearly twice as great, or 39 per cent (40 per cent males and 37 per cent females), and Manners Smith reported an even higher proportion in England.¹

The facet for the talus differs quite markedly as to shape in the Munsee and the whites. In the whites, and particularly in the females, it is predominantly more or less pyriform, and only seldom quadrilateral or nearly so; while in the Munsee conditions are reversed and a more or less quadrilateral facet is present in a large majority of the cases, especially in the males, while the pyriform type is scarce.

The tuberosity of the scaphoid differs also somewhat in the two races. In general, it may be more or less pointed, or decidedly blunt, or squarish; the first two forms are common among the whites, while

¹ Quoted by Cunningham, *Anatomy*, 3d ed., p. 245.

the squarish or angular, rare in the whites, is not infrequent in the Indians. (See pl. 28, *d.*)

The processus plantaris is found generally to be quite pronounced in the Munsee, more frequently so than in the United States whites; and occasionally there exists in the Indian scaphoid an additional tuberosity, separated from the regular one by a groove continuous with that situated between the processus plantaris and the tuberosity.

Cuboid

The cuboid bone, though so irregular, can be fairly conveniently measured as to its maximum length, breadth, and thickness. The method of taking the dimensions is explained in the next table.

There are 19 pairs of cuboids in the Munsee material—9 male and 10 female. Their measurements show the usual predominance of the male bone over the female on both sides and in all dimensions; as to sides, however, the differences are very small, the mean diameter being, in fact, equal on the right and left in both sexes.

LXXXVII. MUNSEE: CUBOID

MALES

	Right						
	Number of specimens (pairs)	Length, maximum*	Breadth, maximum†	Thickness, maximum‡	Module (mean diameter)	Breadth-length index	Thickness-length index
		<i>cm.</i>	<i>cm.</i>	<i>cm.</i>	<i>cm.</i>		
Average.....	(9)	3.77	2.85	2.5	3.04	75.7	66.5
Minimum.....		3.55	2.7	2.3	2.88	70	62
Maximum.....		4	3.15	2.65	3.18	79.7	69.4

	Left						
	Number of specimens (pairs)	Length, maximum	Breadth, maximum	Thickness, maximum	Module (mean diameter)	Breadth-length index	Thickness-length index
		<i>cm.</i>	<i>cm.</i>	<i>cm.</i>	<i>cm.</i>		
Average.....	(9)	3.74	2.85	2.53	3.04	76.2	67.7
Minimum.....		3.55	2.75	2.3	2.86	71.8	62.8
Maximum.....		3.95	3	2.65	3.13	80	74.3

* Between the most prominent points on the superior and inferior borders of the distal or metatarsal face of the bones and the point of the bone at the inferior medial angle ("calcaneal process").

† Maximum breadth, with the cuboid resting on its medial surface in such position as it naturally assumes. This and the measurement given in the next note are obtained readily by the *compas glissière* with broad branches.

‡ Maximum thickness, with the cuboid resting on its anterior surface in such position as it naturally assumes.

LXXXVII.—MUNSEE: CUBOID—Continued

FEMALES

	Right						
	Number of specimens (pairs)	Length, maximum	Breadth, maximum	Thickness, maximum	Module (mean diameter)	Breadth-length index	Thickness-length index
		cm.	cm.	cm.	cm.		
Average.....	(10)	3.54	2.66	2.26	2.82	75.1	64
Minimum.....		3.25	2.3	2.1	2.58	67.6	59.5
Maximum.....		3.85	2.95	2.4	3.03	81.5	67.7

	Left						
	Number of specimens	Length, maximum	Breadth, maximum	Thickness, maximum	Module (mean diameter)	Breadth-length index	Thickness-length index
		cm.	cm.	cm.	cm.		
Average.....	(10)	3.55	2.65	2.26	2.82	74.4	63.6
Minimum.....		3.25	2.35	2.1	2.65	67.1	59.7
Maximum.....		4.8	2.95	2.5	3.03	81.5	71.4

As in the case of the scaphoid, the three measurements of the cuboid give rise to two indexes which express the relative proportion of the bone. Both of these indexes, as seen by the table, are higher in the males than in the females, especially on the left side, showing that the male bone is relatively broader as well as thicker.

The indexes also show slight differences on the two sides, but these are not parallel in the two sexes; in the males both are slightly higher on the right side, while in the females the condition is reversed owing to the fact that while in the males the length of the bone is slightly less on the left, in the females it is slightly greater on that side than on the right.

The Munsee cuboid contrasted with that of the United States whites is, as in all the other bones of the tarsus, slightly smaller in every dimension, and it differs also from the latter to a moderate degree in its relative proportions; but these differences, as seen in the following table, are somewhat irregular and can not be regarded as established before a larger series of specimens is examined.

LXXXVIII. THE CUBOID IN MUNSEE AND IN UNITED STATES WHITES

MALES

	Number of specimens	Length	Breadth	Thick- ness	Module	Breadth- length index	Thickness- length index
		<i>cm.</i>	<i>cm.</i>	<i>cm.</i>	<i>cm.</i>		
Munsee.....	(22)	3.75	2.85	2.52	3.04	75.8	67.1
United States whites.....	(48)	3.96	3.02	2.59	3.19	76.3	65.5

FEMALES

Munsee.....	(24)	3.51	2.63	2.26	2.80	75	64.3
United States whites.....	(36)	3.62	2.67	2.37	2.89	73.7	65.5

As to points for observation, some interest attaches to the cuneiform and talus facets. In the United States whites the facet for the external cuneiform is single in 70 per cent of the cases, divided by a well-marked ridge in 23 per cent, and double, though mostly connected, in 7 per cent of the specimens. In the Munsee, in 45 bones, a single facet is present in 42, or 93 per cent; and one with a ridge in three, or approximately 7 per cent, while two facets occur in no instance.

In the United States whites a facet for the talus was found by the writer in four specimens out of the 82 examined, or approximately 5 per cent. Among 44 cuboids of the Munsee it occurred in only one instance (2.3 per cent), and in this case it was small.

The anterior or metatarsal facet of the cuboid is on the average flatter in the whites than in the Munsee, especially from side to side and in the bones of the males.

Internal Cuneiform

The internal cuneiform is the largest of the cuneiforms and yields two measurements—the greatest height and smallest breadth—which with their indexes are suitable for comparison. There are 45 of these bones in the Munsee material.

The results of the measurements, given in the next table, show the bone in the males to be as usual somewhat larger than in the females. With respect to the sides, the left bone is as high as and very slightly broader than the right in the males (in paired bones); but in the females the left internal cuneiform is very slightly lower and more perceptibly narrower than the right.

The breadth-height index on both sides is higher in the females, which shows that in this sex the bone is not only absolutely but also relatively lower than in the males.

LXXXIX. MUNSEE: INTERNAL CUNEIFORM

MALES

Right				Left			
Number of specimens	Height, maximum*	Breadth†	Breadth-height index	Number of specimens	Height, maximum	Breadth	Breadth-height index
Average:	cm.	cm.			cm.	cm.	
Pairs .....(8)...	3.2	2.27	70.8	(8)	3.2	2.29	71.6
All .....(9)...	3.17	2.24	70.7	(12)	3.17	2.3	72.7
Minimum (all) .....(9)...	2.9	2.05	66.7	(12)	3	2.15	65.2
Maximum (all) .....(9)...	3.35	2.4	77.4	(12)	3.35	2.55	79.7

FEMALES

Average .....(11)...	{ 2.86	2.11	73.8	(11)	2.84	2.06	72.6
	2.86	2.11	73.8	(13)	2.86	2.08	73
Minimum .....(11)...	2.6	1.95	68.9	(13)	2.6	1.9	70
Maximum .....(11)...	3.05	2.4	80	(13)	3	2.3	78.6

* Lower (proximal) branch of the calipers applied to the most prominent parts of the inferior surface of the bone.

† Breadth minimum, in middle of bone, upper branch of calipers resting on both lips of the scaphoid facet; the only practicable breadth in all specimens.

A comparison of the internal cuneiform in the Munsee and in the United States whites shows the bone in both sexes of the latter to be greater in height as well as in breadth. But, as indicated by the indexes, this bone in the whites is in general also relatively higher than in the Indians, as the result of which we have a lower index in the whites in both sexes. This reveals another interesting difference in the osteology of the two groups, which may prove to be of definite racial significance.

The relatively greater narrowness of the internal cuneiform in the female than in the male is equally well pronounced in the whites and in the Munsee, and is probably a universal characteristic.

XC. THE INTERNAL CUNEIFORM IN THE MUNSEE AND IN UNITED STATES WHITES

Males					Females			
	Specimens	Height	Breadth	Breadth-height index	Specimens	Height	Breadth	Breadth-height index
		cm.	cm.			cm.	cm.	
Munsee.....	(21)	3.17	2.28	71.8	(24)	2.86	2.10	73.4
United States whites.....	(50)	3.48	2.43	69.9	(37)	3.16	2.24	71.1

In descriptive features the internal cuneiform of the Munsee offers only minor differences from that of the whites. There seems to be present in the Indians, however, a somewhat greater tendency toward the occurrence of a double anterior or metatarsal facet. Two distinct

facets are present in five of the 45 Munsee bones (11 per cent), as against only one in the 87 bones of the whites (1.1 per cent). On the other hand, an approach to two facets (hour-glass shape, or a division of the one facet by a ridge) occurs in the Munsee in a little more than 13 per cent of the specimens, and in the whites in a little more than 10 per cent.

External and Middle Cuneiform

The external and middle cuneiform bones in the Munsee resemble closely those of the whites, but average slightly smaller in size.

Among 35 external cuneiforms, 10, or approximately 30 per cent, show absence of the facet for the fourth metatarsal, and one an absence of both facets for the second metatarsal.

As to the middle cuneiform, the central ligamentous depression on its medial surface, and especially the canal running downward from this, are characteristic features of the Indian bone and are more pronounced in both sexes than is the average in whites.

SUMMARY OF MEASUREMENTS AND OBSERVATIONS ON PARTS OF THE MUNSEE SKELETON OTHER THAN THE SKULL

The bones of the Munsee skeleton agree closely, in a general way, with those of other Eastern Indians. Contrasted with those of whites they present many close resemblances, but also certain marked differences, one of which being that they are less stout.

Humerus.—The mean length of the humerus is in no way exceptional. In the female this bone is relatively long. The right and left humeri are of the same length in males, but the left is slightly shorter than the right in females. The shaft is flatter than in whites, in consequence of which the shaft index is lower. The breadth or antero-posterior diameter of the shaft of the right bone is greater than that of the left, while the thickness is practically the same. The shape of the shaft is frequently plano-convex (juvenile). Perforation of the septum exists in 22 per cent of the males and in 59 per cent of the females. Of the supracondyloid process there are only slight traces.

Radius.—The radius is decidedly long in the Munsee in relation to the humerus in both sexes, the result of which is a high radio-humeral index. The right and left radii are of equal length in males, but, as with the humerus, the left radius averages slightly shorter in the females.

Ulna.—The ulna presents nothing exceptional; it is shorter on the right in females, as in the case of the radius.

Femur.—The form of the femur is generally ordinary. The length corresponds to the average stature of 167 cm. in males and 156 cm. in females.

The excess of maximum over bicondylar length is greater than in whites, indicating greater obliquity of axis. The relation in length of the female femur to that of the male is very nearly the same as in whites; and the same applies to the relation of the femoral to humeral length.

At the middle of its shaft the femur is slightly broader on the right side than on the left, in consequence of which the shaft index is higher on the left. This index is decidedly smaller in both sexes of the Munsee than in whites, owing to the lesser breadth of the shaft in the Indian.

The subtrochanteric flattening is quite pronounced, giving a platymeric index considerably below that of the whites, but agreeing with that in other Indians. The index is lower on the left side than on the right, and slightly higher in females than in males.

The shape of the shaft is most frequently the ordinary prismatic. The elliptic type is rare. Cylindrical and four-surface types are absent.

The third trochanter in some form and degree exists in more than two-thirds of the bones, but is rarely pronounced.

Tibia.—The female Munsee tibia is not only absolutely but also relatively shorter than that of males; nevertheless, in both sexes the bone is relatively longer than in whites, in consequence of which the tibio-femoral index is high.

Platynemy is infrequent; in the females the shaft is stout in many instances. In the shape of the shaft there is a frequency of the four-surface type.

Fibula.—The shape of the fibula is most frequently lateral prismatic or fluted.

Clavicles.—The clavicle in the female is relatively short. The right clavicle is slightly longer than the left in the males, shorter in the females.

Sternum.—The manubrium is generally detached; the bone is of moderate dimensions; frequent minor asymmetries; rib facets irregular in number. Curvature and measurements moderate; sternum of female relatively shorter.

Scapula.—The scapula is smaller than that of ordinary whites, especially in height. Scapular index high, showing the bone to be relatively broad, particularly in the females. Infrascapular index also high, even by comparison with that in other Indians.

The shape of the body is mostly quadrilateral or pentagonal. The superior border is frequently semilunar. The scapular notch in the males is often deep or converted into a foramen.

Ribs.—The ribs show remarkable freedom from fractures. Cervical rib present in one instance, 22 ribs only in another. In three-fourths of the cases the first ribs are semilunar in form.

Spine.—The spine is of moderate regular development. There are several numerical and structural anomalies.

Sacrum.—The dimensions of the sacrum are close to those of white males, but the female Munsee sacrum is shorter. The sacral index is not far from that in whites.

The sacrum shows the presence of six segments in one-fifth of the cases. The curvature is moderate to medium, and begins rather frequently below the first segment.

Pelvis.—Innominate bones absolutely smaller but relatively broader in females than in males. Breadth-height index lower than in whites. The pelvis as a rule is free from deformation. Male pelvis larger and relatively higher than the female, giving higher height-breadth index. Pelvic cavity in no case abnormal, but differs considerably in measurements; in general it is relatively deep at the brim, as a result of which it gives a high brim index.

Short and other bones: Patellæ.—The patella averages somewhat smaller in size than in whites. Male bone larger than female, but no difference in either sex on the two sides. The male Munsee patella is relatively somewhat shorter than that of the whites. Frequency of vastus notch.

Bones of hand.—Very free from anomalies. Moderate dimensions throughout. Metacarpo-humeral index lower than in whites, indicating relatively small hand.

Bones of feet.—First metatarsal shorter, both absolutely and relatively to the femoral length, than in whites, indicating relatively smaller feet.

Os calcis.—Bones of the two sides almost equal in size; very slight excess on right. Male bone relatively stouter than female, giving higher breadth-length and breadth-height indexes. The bone is smaller in all dimensions than that in ordinary whites of similar stature. The female os calcis is shorter and lower, but as slender as that of the whites.

The numerical variation of the facets for the astragalus is much the same as in whites, but in the latter the anterior and middle facets are much more frequently wide apart.

Astragalus.—Smaller in all dimensions than in whites. Equal on the two sides in males, but slightly higher on the left than on the right in the females. This bone is not only absolutely but relatively shorter and lower than that among the whites.

The facets for the os calcis do not harmonize fully with those on the os calcis itself, being less differentiated and more frequently connected or fused.

Scaphoid.—The scaphoid is smaller than in whites, also relatively less stout and frequently relatively less high than in the whites. The right scaphoid is larger than the left.

Cuboid facets are less common than among whites, and the facet or the astragalus differs markedly in shape from that of the white caphoid. There are likewise differences in tuberosity and in process plantaris.

Cuboid.—The cuboid is smaller than in whites; differences in the relative proportions are irregular. The right and the left bone are about equal.

Racial differences exist in cuneiforms and talus facets.

Internal cuneiform.—Smaller than in whites, also relatively lower. The female bone is relatively narrower than the male; there are some differences as to side.

Relative frequency of double metatarsal facet.

Middle cuneiform.—The depression in the medial surface and also the canal running from this are more pronounced in both sexes than in whites.

II. EASTERN INDIAN CRANIA IN GENERAL

GENERAL OBSERVATIONS

In connection with the study of the Munsee and in order to clarify, if possible, the physical affiliations of this important group of the Lenape, the writer undertook an examination of all crania of the Eastern Indians that now exist in the collections of the United States National Museum, the Peabody Museum of American Archæology and Ethnology at Cambridge, Phillips Academy at Andover, the American Museum of Natural History in New York, The Academy of Natural Sciences of Philadelphia, and the Valentine Museum at Richmond, in addition to a number of specimens sent to him from other institutions.¹ The total number of crania studied in the course of this investigation aggregated 253, of which 121 were of males and 132 of females.

Former records on American crania from Eastern Indians are scarce, and in most instances so imperfect or antiquated as to be of little value. The earliest data are those of Morton and Meigs,² based on the collections now in The Academy of Natural Sciences of Philadelphia. In 1862 Sir Daniel Wilson, of Toronto, published his *Pre-historic Man*, in two volumes, in the second volume of which he gives measurements of 39 male and 18 female Huron (Iroquois) skulls. Unfortunately these measurements are few in number, are recorded in inches, and were determined with instruments of whose character there is no record, although presumably they were such as had been used by Morton and Meigs. Later brief references to eastern Canadian crania by Dr. David Boyle will be found in the *Annual Archæological Reports* of Ontario. In 1867 measurements of five Algonquian and Iroquois skulls were included by Dr. J. Barnard Davis in his *Thesaurus Craniorum* (pp. 224-5), and in 1879 a few measurements of four Huron skulls were given by Quatrefages and Hamy in their *Crania Ethnica* (parts 10-11, p. 472).

In 1880 there appeared, in the *Memoirs of the Boston Society of Natural History*, a paper of 10 pages, with 2 plates, by Lucien Carr, at that time assistant curator of the Peabody Museum at Cambridge, on the crania of New England Indians, in which measurements of 67 skulls are given; but, as the present writer found subsequently by

¹ See the Appendix, page 127.

² *Crania Americana, Catalogue*, and other contributions. See the bibliographies in the writer's *Physical Anthropology in America*, *Amer. Anthropologist*, 1914, xvi, pp. 508-554.

examination and remeasurement of some of the same specimens, the sexual identification, as well as the measurements, were too faulty to warrant their use in this report. During the same year there appeared *A List of the Specimens in the Anatomical Collections of the United States Army Medical Museum*, by Dr. George A. Otis, which gave measurements of hundreds of American crania, including a number from the Eastern states; but these measurements also in many instances were made imperfectly, so that the records can not be profitably utilized. Flower's *Catalogue* gives the measurements of one Mohawk skull. Virchow, in his *Crania Ethnica Americana*, includes no specimen from the central or northern states bordering on the Atlantic. In 1899 Dr. Frank Russell¹ published some observations and measurements on Indian crania, among which were included a number from the New England states, more particularly from Massachusetts; and finally, in 1902, the writer published his *Crania of Trenton*,² which gave measurements of all the Lenape skulls, as well as those of some other Eastern Indians, then known.³

All the specimens described by the American authors above mentioned and that could still be located (which was possible in a large majority of the cases), were reexamined, consequently the following records are based solely on the measurements and observations by the present writer. Important additional Huron material, which it was found impracticable to include in these studies, exists in the museum of Laval University at Quebec and in the Provincial Museum at Toronto.

The 283 crania here included are not distributed evenly over the Atlantic states. There are fairly representative series from eastern Canada, Massachusetts, New York, New Jersey, and Virginia, but only a few specimens from Connecticut, and very few from Delaware, Maryland, and Pennsylvania. The climatic conditions and the soil of the more southerly of these states are not favorable to the preservation of skeletal remains, which, moreover, were probably never very abundant. Furthermore, many of the specimens available for examination were found more or less damaged, so that not all the important measurements could be obtained. Owing to these conditions the present study must necessarily leave many points for future corroboration or correction; however, the results obtained

¹ *American Naturalist*, 1899, p. 33.

² *Bulletin Amer. Museum of Natural History*, xvi, pp. 23-62.

³ Just as this memoir is about to go to the printer, there appears a study, by Marian Vera Knight, on *The Craniometry of Southern New England Indians* (Yale Univ. Press, 1915, iv, pp. 1-36, 9 pl.), constituting a report on approximately 90 skulls, many of them imperfect, from Massachusetts and Rhode Island. A majority of the specimens are those that have already been studied by Carr and Russell, and more especially by the present writer. The results agree closely with those shown in this report, although Miss Knight includes some specimens that may safely be regarded as extraneous, and has not been entirely fortunate in the matter of some of her measurements and comparisons.

shed much light on the physical characteristics and relations of the Eastern Indians.

As above noted, the collections included cover the territory from southeastern Canada to Virginia, and, roughly speaking, from the easternmost lakes and the Appalachian mountains to the Atlantic. From northward and northwestward of this region skeletal material is scarce, and the same is true of the Southern states until we reach Florida; while to the westward the conditions are more complex and will best form part of a separate discussion.

The entire region covered by the collections, with a single exception, is characterized by a complete absence of both intentional and cradle-board deformation of the skull; the exception applies to the Munsee, among whom prevailed to a moderate extent the practice of frontal (fronto-occipital) compression. As this practice was very general to the southward and southwestward of the section here involved and was completely absent elsewhere beyond its boundaries, its occurrence among the Munsee, even to a limited extent, indicates that this tribe had some close connection in those directions, in which respect it differs from the rest of the Lenape. The well-known accession to the tribe, in the latter part of the seventeenth century, of some Shawnee, whose home was to the southwestward as far as Kentucky and Tennessee, may, as already suggested, explain this occurrence.

A consequential result of the study of the Eastern crania here included is that they all belong to one and the same fundamental type, which we now know in the northeast as that of the Algonquian and Iroquois, in the west as the Shoshonean, farther south as the Piman-Aztec, and in South America as the Andean, "Lagoa Santa," or Pampas type. However, in the territory under consideration, as elsewhere, this type is far from being homogeneous, differing sometimes in an important way almost from tribe to tribe. The differences are evidently due partly to intermixture with the other or brachycephalic American type and partly to locally developed or perpetuated variations.

In the several series of skulls here dealt with there is plain evidence of admixture in the majority of the groups, which, though mostly slight, increased from the north to the south. This admixture consists uniformly of brachycephalic elements, in some localities males, in others females, which doubtless were derived from farther west, southwest, and south. There are only four groups from which such admixture is absent, namely, those from Maine, Massachusetts, Connecticut, and Long Island. The conditions in this respect are presented in the following table:

XCI. PRESENCE OF BRACHYCEPHALIC INDIVIDUALS AMONG EASTERN TRIBES

Tribe or district	Males		Females	
	Skulls examined	Brachycephals in the group	Skulls examined	Brachycephals in the group
Hurons of southeastern Canada.....	15	2	5	
Maine.....	6		6	
New Hampshire.....			1	
Massachusetts.....	14		25	
Rhode Island.....	7	1	6	1
Connecticut.....	4		4	
New York.....	19		18	3
Manhattan Island.....	3	1		
Long Island.....	7		5	
Staten Island.....	6	2	3	
Munsee.....	10		13	4
Other Lenape.....	11	3	23	3
Maryland.....	6	2	4	
Virginia.....	30	4	32	4
Total.....	138	* 15	145	† 15

* 10.9 per cent.

† 10.3 per cent.

In all these cases the brachycephaly, and frequently other features of the skulls, were such that they could not possibly be attributable to a mere fluctuation of the prevalent type.

The individuals whom such specimens represent were probably recent accretions by the tribes through marriage or adoption. Other increments of similar nature doubtless occurred in the past, and, blending more or less thoroughly with the tribes, modified the physical types of these to a greater or less extent. * It is evidently due to this influence that, as will be shown later, the more southerly tribes of the region under consideration—those which were nearest the more westerly, southwesterly, and southerly brachycephals—show a higher cranial index than the more northerly and purer tribes.

The principal numerical results of the measurements derived from the Eastern Indian crania are given at the end of this section. These may be summarized briefly: The type is characterized by marked to moderate dolichocephaly in the males, and by moderate dolichocephaly to mesocephaly in the females; by medium to high vault, with occasionally a low forehead; by good size of the skull as a whole, and lack of unusual thickness of its bones; by moderately high to high face, the latter especially frequent in the males; by moderate, seldom great, breadth of face; by considerably varying orbital dimensions and index, with a predominance of mesoseme forms, but reaching, even in the averages, from microseme to megaseme; by the frequency of moderate size in the nasal aperture; by variable nasal index, with a large predomi-

nance, however, of the mesorhynch form; by a rather short palate in many instances; and by a moderate degree of facial as well as of alveolar prognathism.

CRANIAL INDEX

The distribution of the most important characteristic of the skulls, the *cranial index*, will be more clearly apparent from the next table. Owing to the paucity of crania in some of the series, there are irregularities between the males and females of the same group, and the position of the different groups in the line is probably not in every case correct. Nevertheless, certain conditions are clearly brought out. It is seen on the whole that the dolichocephaly decreases in a slight ratio from the north to the south; but its lower extreme is found on Long Island, Staten Island, and Manhattan Island, New York. The crania from these three localities show striking resemblances, and though there are also certain differences, the conclusion seems to be justified that they belong to one group. It has been suggested¹ that the Indians of Staten Island were a branch of the Lenape, but the evidence offered by the skeletal remains gives no corroboration of this. There may have been Lenape women, or even some Lenape admixture, in the Staten Island tribe, but the crania of the men show almost uniformly distinct features which identify them clearly with the Indians of Manhattan Island and Long Island.

XCII. EASTERN INDIAN CRANIA: CRANIAL INDEX

	Males		Females	
	Number of specimens	Index	Number of specimens	Index
Long Island.....	(7)	70.7	(5)	74.3
Manhattan Island.....	(2)	71.7	(1)	71.8
Staten Island.....	(4)	71.7	(3)	75.4
Connecticut.....	(4)	72.4	(4)	74.6
Maine.....	(6)	72.7	(6)	74.7
Massachusetts.....	(14)	72.8	(25)	74.7
Southeastern Canada.....	(14)	73.4	(5)	76.9
New York State.....	(19)	73.5	(15)	74.8
Maryland.....	(4)	73.6	(4)	74.0
Rhode Island.....	(6)	73.7	(5)	75.6
New Jersey (Heye collection).....	(4)	73.9	(5)	75.8
New Jersey (earlier).....	(6)	74.6	(19)	75.1
Virginia.....	(27)	75.5	(28)	76.3

There is remarkable similarity in the average index of the crania of all the more northerly states as far as New Jersey. The Indians of both sexes from Maine and Massachusetts are particularly close in

¹ See A. Skinner in *The Indians of Greater New York and the Lower Hudson*, edited by Clark Wissler, *Anthropological Papers of the American Museum of Natural History*, III, 1909.

this respect, and, as will be seen later, these two groups, while not entirely homogeneous, show many other close similarities.

The most important result is that shown by the crania from southeastern Canada, which are almost entirely Huron or Iroquois; and by the specimens from New York State, which also are largely of Iroquois derivation. The Iroquois, as is well known, are regarded as a linguistic stock distinct from the Algonquian, though there are some lexical resemblances in the two languages. But the measurements of the skulls of representatives of the two stocks show no such distinction. In fact, the Iroquois occupy, with reference to nearly all important cranial features, more or less of a median position among the Algonquian groups, and there is no basis on which they can legitimately be segregated as belonging to any different physical group of Indians. It is quite possible that some of the Iroquois tribes may have been derived, in smaller or larger part, from other peoples of the westward or the southwestward, or that in course of time they became mixed with such; but the greater proportion of the Iroquois can henceforth be no more separated in physical anthropology from the Algonquians than can any of the subgroups of the latter.

Another important result of these studies relates to the Lenape. The Munsee and other Delaware Indian skulls, while nearing (and in the case of females slightly surpassing) the upper limits of dolichocephaly, are nevertheless sufficiently closely related to the crania from the neighboring states to show that the Munsee, and the Lenape as a whole, were in all probability only subdivisions of the eastern Algonquians. Resemblances in other important features of the skull, as well as of the skeleton, make this conclusion quite definite, thus eliminating the theory of the migration of the Lenape from beyond the Mississippi, for if such were the case, they could scarcely fit so precisely into the anthropological position they occupy between the neighboring tribes. Yet, as previously mentioned, there is some evidence, especially that afforded by the Munsee, that the Lenape had some connection, probably earlier as well as recent, with tribes living southwestward from the Appalachian mountains.

From the limited Pennsylvania material it appears that the eastern lowlands were occupied by Indians of the Algonquian or Lenape type, while in the more westerly parts brachycephaly was frequent if not common.

As to the Virginia Algonquians, they show the highest cranial indexes of all the groups here considered, and had doubtless considerable foreign blood, derived from the west or the south. It would be interesting to compare the Virginia Indians with the Siouan tribes, to which they seem to bear close affinity.

HEIGHT OF SKULL

Next to the cranial index, the most important feature of the vault of the skull is its height, and the Eastern crania, as already stated, are characterized by good to pronounced development in this direction. The averages of the measurements, and those of the ordinary height-length and height-breadth indexes, will be found in the final tables, but none of these are very satisfactory for showing the true value of this dimension, which on the one hand is proportionate to the size of the skull, and on the other stands in a more or less compensatory relation with both the length and breadth of the vault. It has long been felt by the writer that some expression of the real relative value of the height measurement was required, and this need led him ultimately to compare it not with the very variable length or breadth of the skull, but with the mean of these two measurements. The resultant index, which may be called simply the height index of the vault, gives us a new means of comparison and classification of the skull and promises to prove much more satisfactory than the two older indexes. In the Eastern crania here described, it ranges from 83 to almost 90, and the arrangement of the various tribes on its basis is harmonious and of considerable interest. The main points brought out by the index are as follow:

In the northernmost tribes the height of the skull is on the whole relatively lower than in those farther south. The Munsee and other Lenape crania agree with those of the more northerly groups, but differ somewhat from each other, the skulls in the Heye collection being in both sexes perceptibly lower than those of the other Lenape. The Staten Island, Manhattan Island, and Long Island skulls are again grouped, so far as the more important male skulls are concerned, and are all high. Of the Virginia collections, the first series, from various eastern localities, shows a medium height or slightly above; but the Valentine collection, from a more westerly part of the state,¹ gives in both sexes the highest index of all the groups, showing the greatest relative height and indicating that this group had been subjected to influences which did not affect equally the Indian population of other parts of the state.

¹ For details concerning this collection, see Report of the Exploration of the Hayes Creek Mound, Rockbridge County, Virginia, *Publ. Valentine Museum*, Richmond (ca. 1892).

XCIII. EASTERN INDIAN CRANIA: HEIGHT INDEX*

	MALES		FEMALES	
	Number of specimens	Index	Number of specimens	Index
Maine.....	(6)	83	(6)	83.5
New Jersey (Heye collection).....	(4)	83.9	(5)	83.2
New York.....	(19)	84.4	(15)	83.6
Southeastern Canada.....	(14)	84.4	(5)	85.7
Massachusetts.....	(14)	84.6	(25)	86.1
Rhode Island.....	(6)	85.3	(5)	86.4
New Jersey (earlier).....	(6)	86.1	(21)	85.1
Virginia (miscellaneous).....	(12)	86.5	(7)	85.25
Connecticut.....	(4)	86.5	(4)	85.4
Staten Island.....	(4)	87.5	(3)	84.2
Manhattan Island.....	(2)	87.5	(1)	(88.4)
Long Island.....	(7)	88.1	(5)	84
Virginia (Valentine collection).....	(15)	89.8	(21)	86.7

$$*H \times 100 + \frac{(L+B)}{(2)}$$

SIZE OF SKULL

The size of the skull of the Eastern Indian, as expressed by the cranial module, shows again a grouping of much interest, though here more than in other series, owing to the small number of specimens, the position of some of the tribes can not be regarded as definitely fixed. The Munsee, as well as other Lenape skulls, stand with those of Rhode Island at the lower end of the scale, showing the smallest heads, although the Indians of these localities were not tribes of smaller stature than most of the other Eastern Indians. The more northerly Algonquians (with the exception of those of Rhode Island) and the Iroquois, occupy a median position. In the Virginia tribes the size of the skull ranges from medium to slightly above in the more easterly, but slightly below medium in the more westerly tribes. The crania from Manhattan, Long Island, and Staten Island are again grouped and occupy the highest position in the series, showing the largest heads; but they were also among the tallest, if not the tallest, of the Eastern Indians.

XCIV. EASTERN INDIAN CRANIA: CRANIAL MODULE

	Males		Females	
	Number of specimens	Cranial module	Number of specimens	Cranial module
		<i>cm.</i>		<i>cm.</i>
Rhode Island.....	(6)	15.22	(4)	14.84
New Jersey (earlier).....	(4)	15.33	(14)	14.64
New Jersey (Heye collection).....	(7)	15.44	(9)	14.75
Virginia (Valentine collection).....	(11)	15.46	(13)	15.0
Southeastern Canada.....	(14)	15.48	(5)	14.77
Maine.....	(6)	15.55	(5)	14.92
Connecticut.....	(2)	15.55	(3)	14.84
Massachusetts.....	(12)	15.56	(22)	14.72
Virginia (miscellaneous).....	(6)	15.58	(2)	14.74
New York State.....	(17)	15.62	(14)	14.71
Manhattan Island.....	(2)	15.67	(1)	14.93
Long Island.....	(5)	15.71	(5)	14.91
Staten Island.....	(4)	16.04	(3)	14.73

XCV. EASTERN INDIAN CRANIA: VAULT*

MALES

Group	Num- ber of speci- mens	Length	Breadth	Height	Cra- nial mod- ule	Cra- nial index	Height- length index	Height- breadth index	Cra- nial capac- ity	Thick- ness left pari- etal
		<i>cm.</i>	<i>cm.</i>	<i>cm.</i>	<i>cm.</i>				<i>c. c.</i>	<i>mm.</i>
Southeastern Can- ada.....	(14)	18.84	13.82	13.78	15.48	73.4	73.1	99.7		
Maine.....	(6)	19.1	13.9	13.7	15.55	72.7	71.9	98.8		
Massachusetts.....	(14)	18.93	13.78	13.94	15.56	72.8	73.5	101		
Rhode Island.....	(6)	18.43	13.58	13.65	15.22	73.7	74.1	100.5		
Connecticut.....	(4)	18.65	13.5	13.9	15.55	72.4	73.5	100.4		
New York State....	(19)	19	13.97	13.92	15.62	73.5	73.6	99.5		
Manhattan Island..	(2)	19.05	13.65	14.3	15.67	71.7	75.1	104.8		
Long Island.....	(7)	19.1	13.5	14.36	15.71	70.7	74.9	105.7		
Staten Island.....	(4)	19.5	14	14.66	16.04	71.7	75.2	104.9		
New Jersey (earlier)	(6)	18.5	13.8	13.9	15.33	74.6	75.8	101.2		
New Jersey (Heye collection).....	(7)	19.05	14.1	13.9	15.44	73.9	73.1	98.9	1544	5
Delaware.....	(1)	(19)	(14)			(73.7)				
Maryland.....	(4)	19.2	14.15	(13.6)	(15.57)	73.6	(71.6)	(96.5)		
Virginia (miscella- neous).....	(12)	18.6	14	14.1	15.58	75.5	76.2	99.3		
Virginia (Valentine collection).....	(15)	18.2	13.75	14.35	15.46	75.5	79	103.2		

*Measurements in parentheses are derived from a single specimen.

XCV. EASTERN INDIAN CRANIA: VAULT—Continued

FEMALES

Group	Number of specimens	Length	Breadth	Height	Cranial module	Cranial index	Height-length index	Height-breadth index	Cranial capacity	Thickness left parietal
		<i>cm.</i>	<i>cm.</i>	<i>cm.</i>	<i>cm.</i>				<i>c. c.</i>	<i>mm.</i>
Southeastern Canada.....	(5)	17.55	13.5	13.3	14.77	76.9	75.7	98.3	.....	.....
Maine.....	(6)	18.1	13.5	13.2	14.92	74.7	73.4	97.8	.....	.....
New Hampshire.....	(1)	(17.8)	(12.6)	.....	.....	(70.8)	.....	.....	.....	.....
Massachusetts.....	(25)	17.7	13.2	13.3	14.72	74.7	75.5	100.9	.....	.....
Rhode Island.....	(5)	17.8	13.45	13.5	14.84	75.6	76.6	100.2	.....	.....
Connecticut.....	(4)	17.85	13.3	13.3	14.84	74.6	74.9	98.8	.....	.....
New York State.....	(15)	17.8	13.3	13	14.71	74.8	72.5	96.6	.....	.....
Manhattan Island..	(1)	(18.1)	(13)	(13.7)	(14.93)	(71.8)	(75.7)	(105.4)	.....	.....
Long Island.....	(5)	18.1	13.45	13.25	14.91	74.3	73.2	98.5	.....	.....
Staten Island.....	(3)	17.7	13.4	13.1	14.73	75.4	73.9	98	.....	.....
New Jersey (earlier)	(21)	17.6	13.2	13.1	14.64	75.1	74.9	97	1326	.....
New Jersey (Heye collection).....	(9)	17.6	13.4	12.9	14.75	75.8	73.1	96.4	1285	4.3
Maryland.....	(4)	18.1	13.4	.....	(14.87)	74	(70.1)	(97)	.....	.....
Virginia (miscellaneous).....	(7)	17.7	13.5	13.3	14.74	76	75	100.7	.....	.....
Virginia (Valentine collection).....	(21)	17.75	13.6	13.6	15	76.4	76.9	99	.....	.....

FACIAL MEASUREMENTS

HEIGHT OF THE FACE

The height of the face stands largely, though not absolutely, in correlation with the length of the head, a feature which becomes apparent also in our series. The collections from more westerly Virginia and the Lenape groups, all of which show rather short crania, give also the shortest faces. Maine and Massachusetts follow, with Rhode Island and New York. The Indians of Staten Island, Long Island, and Manhattan Island, so far as the males are concerned, all find a place in the upper half of the series, with long faces, and the same is true of the few more easterly Virginia specimens in which the face could be measured, and of the males of southeastern Canada. The latter, with those of Manhattan Island, occupy the upper limit of the scale. The females throughout show more uniformity than the males in their measurements.

BREADTH OF THE FACE

The breadth of the face, as measured by the diameter bizygomatic maximum, stands in a measure in correlation with the breadth of the head, but as it depends very largely on the degree of development of the temporal muscles and as a pronounced development of these muscles, while broadening the zygomatic arches, tends at the same

time to restrict the development of the skull in breadth, there are many irregularities in this correlation. In our series, Rhode Island, Maine, Massachusetts, and Connecticut occupy the lowest positions in the scale, showing faces that for Indians are decidedly narrow. Among the Lenape the faces are about medium, and the same is true of the more westerly Virginians. On Manhattan Island and Staten Island the face was well above the medium in breadth, but not so on Long Island, although the somewhat exceptional position of the Long Island Indians in this respect may be accidental. The Indians of southeastern Canada and New York State, as well as some of the Virginia Indians, had faces decidedly broader than the averages of those of the northeastern states bordering on the Atlantic.

Comparing the average facial breadth with facial height, it is seen that in most of the tribes noted the two measurements occupy a similar position in the scale, the narrow faces being also short, and vice versa; but there are several exceptions.

XCVI. EASTERN INDIAN CRANIA: FACE

Prosthion-nasion height					Diameter bizygomatic maximum				
Group	Males		Females		Group	Males		Females	
	Number of specimens	P.-N.	Number of specimens	P.-N.		Number of specimens	D. biz. max.	Number of specimens	D. biz. max.
		cm.		cm.			cm.		cm.
New Jersey (Heye collection)	(7)	7.15	(5)	6.9	Rhode Island.....	(6)	13.35	(3)	13
New Jersey (earlier)			(11)	6.8	Maine.....	(2)	13.45	(4)	12.95
Virginia (Valentine collection).....	(4)	7.3	(5)	6.9	Massachusetts.....	(7)	13.7	(8)	12.7
Maine.....	(3)	7.4	(4)	6.8	Connecticut.....	(2)	13.8	(2)	12.3
Massachusetts.....	(8)	7.4	(15)	7	Long Island.....	(4)	13.85	(4)	12.95
Rhode Island.....	(3)	7.4	(4)	7.1	Virginian (Valentine collection).....	(4)	13.85	(6)	13.1
Connecticut.....			(2)	6.85	New Jersey (earlier)			(9)	12.7
New York State.....	(10)	7.4	(11)	6.9	New Jersey (Heye collection)	(7)	13.9	(6)	12.8
Staten Island.....	(3)	7.45	(2)	6.5	New York State.....	(13)	14.05	(9)	13.1
Virginia (miscellaneous).....	(2)	7.5			Eastern Canada.....	(9)	14.1	(5)	12.6
Long Island.....	(4)	7.5	(4)	7	Manhattan Island.....	(1)	14.3		
Southeastern Canada.....	(7)	7.8	(5)	6.75	Staten Island.....	(3)	14.7	(2)	12.65
Manhattan Island.....	(2)	7.95			Virginia (miscellaneous)	(2)	14.7		

ORBITS

While describing, in 1902, the skulls of the more easterly Lenape, the writer was impressed by the occasional appearance of very low orbits, and considered at the time the possibility of this feature being characteristic of the tribe. The present examination shows,

however, that remarkably low orbits were frequent among some of the tribes of the eastern Algonquians, and that the Munsee and Lenape skulls occupy, with respect to the average orbital index, only a median position. The lowest orbits in the mean were found among the males of Long Island and of the North Atlantic states. Maine and Massachusetts again stand exceedingly close together, with fairly low indexes, while Manhattan Island and Staten Island are about medium. The females of Staten Island show in this, as in other respects, a lack of harmony with the males, with lower index. The highest orbits are found in the skulls from southeastern Canada and Rhode Island, and in both of the series from Virginia. On the whole, the extensive variation of the absolute and relative dimensions of the orbits among the eastern Algonquians (and Iroquois) is very remarkable. Its chief cause in the males is the unequal development of the supraorbital ridges; in the females, excepting in two or three groups, the proportions and indexes are more nearly alike.

XCVII. EASTERN INDIAN CRANIA: FACE

Group	Orbital index				Group	Nasal index			
	Males		Females			Males		Females	
	Number of specimens	O. I.	Number of specimens	O. I.		Number of specimens	N. I.	Number of specimens	N. I.
Long Island.....	(5)	82.6	(5)	87.4	Manhattan Island....	(2)	44.9	.....	.....
Connecticut.....	(2)	84.6	(3)	92.1	Maine.....	(4)	45.6	(4)	50
Maine.....	(4)	86.2	(4)	86.2	Long Island.....	(5)	46.7	(5)	49
Massachusetts.....	(10)	86.3	(2)	88.8	Connecticut.....	(2)	49	(2)	54.7
New York State.....	(16)	86.8	(13)	88.6	Southeastern Canada.	(8)	49.1	(5)	53.4
Manhattan Island....	(2)	87.4	(1)	87.8	Massachusetts.....	(10)	49.7	(20)	49.5
New Jersey (earlier)..	.....	.....	(13)	87.2	Virginia (miscellaneous)	(3)	50.6	(1)	52
New Jersey (Heye collection)	(7)	87.5	(7)	91.7	New Jersey (earlier)	.....	.....	(13)	51.5
Staten Island.....	(3)	87.6	(3)	83	New Jersey (Heye collection)	(7)	51.1	(9)	52.9
Southeastern Canada.	(10)	87.8	(5)	89.5	New York State.....	(15)	51.8	(13)	53.2
Virginia (Valentine collection).....	(10)	87.9	(6)	89	Rhode Island.....	(6)	52.5	(5)	52.1
Virginia (miscellaneous).....	(5)	88.9	(2)	85.6	Staten Island.....	(3)	53.1	(3)	54.4
Rhode Island.....	(6)	90	(5)	89	Virginia (Valentine collection)	(8)	53.5	(6)	54.3

NASAL INDEX

Among the Eastern Indians, the nose, as already mentioned, is in general relatively small, and the aperture presents often fairly sharp borders, an exceptional feature among Indians of most other parts of the continent. The nasal aperture, or more properly the

relation of the breadth to the height of the nose, expressed by the nasal index, differs considerably in the different tribes. The index is low in the northeastern states, on Manhattan Island and Long Island, and in southeastern Canada; medium among the Munsee and other Lenape, among the more easterly Virginia tribes and in New York State; and elevated on Staten Island and in the more westerly Virginians. It was also elevated in both sexes in Rhode Island, which is of interest in that the specimens from that state show a somewhat exceptional position in other respects. On Staten Island, the crania of which stand in regard to nasal index apart from those of Manhattan Island and Long Island, with which they are otherwise so closely related, the character may have been influenced by admixture through the accession of females.

PALATE

The relative proportions of the dental arch, as expressed by the "palatine" index, show shortest palates in the northeastern states and longest among the Lenape; but the differences are not very marked.

XCIII. EASTERN INDIAN CRANIA: FACE

Group	Palatine index				Group	Angle of facial prognathism			
	Males		Females			Males		Females	
	Number of specimens	P. I.	Number of specimens	P. I.		Number of specimens	Angle, degrees	Number of specimens	Angle, degrees
Massachusetts.....	(5)	113.2	(8)	115.4	Connecticut.....			(2)	68
Manhattan Island.....	(2)	113.2			Rhode Island.....	(3)	69	(2)	73
Maine.....	(3)	113.8	(4)	113.8	New York State.....	(7)	71	(10)	72.5
Virginia (Valentine collection).....	(3)	114.1	(5)	116.4	Southeastern Canada..	(5)	72	(3)	72
New York State.....	(2)	116			Maine.....			(3)	72
Rhode Island.....			(3)	116.1	Massachusetts.....	(4)	73	(3)	71
Staten Island.....	(2)	116.5			New Jersey (Heye collection).....	(6)	73	(5)	74
Southeastern Canada..	(4)	117.3	(3)	115.8	Long Island.....	(4)	74	(3)	71
New Jersey (Heye collection).....	(8)	120.7	(5)	120.5	Virginia (Valentine collection).....			(5)	74
New Jersey (earlier).....			(2)	121.2	Staten Island.....	(3)	76	(1)	75

PROGNATHISM

Facial prognathism did not differ very greatly in the different groups, yet there is a perceptible tendency toward a greater orthognathism among Indians of the northeastern states and Canada, and to somewhat greater protrusion among those of Long Island and Staten Island, the Munsee, and the Virginians of the Valentine collection. Alveolar prognathism (see table for details) was most

pronounced on Manhattan Island, Long Island, and Staten Island; east among the New York Indians and among those of south-eastern Canada, Maine, and Massachusetts.

It is evident from the data presented above, that the eastern Algonquian (and Iroquois) Indians, while essentially of one type, approached purity of type much more in the northeastern Atlantic states and in southeastern Canada than farther south. It is further plain that the stock presented numerous and occasionally marked localized or tribal as well as individual variations, and that in several of the states, and possibly even in Rhode Island, it was modified more or less by admixture with individuals of both sexes from across the Appalachians or the south. A locally differentiated group which in many respects already stood more or less apart from the neighboring tribes and was also characterized especially by more than average development, is the cluster of tribes of Manhattan Island, Long Island, and Staten Island. The Munsee and other Lenape stand in close relation in many important respects, though they exhibit also some differences; and both of them, as already shown, agree with the rest of the eastern Algonquians, more especially with their immediate neighbors to the north and south.

The tables of detail measurements of the Eastern Indian crania follow.

XCIX. EASTERN INDIAN CRANIA: FACE (DETAILS)

MALES

Group	Number of specimens	Upper height	Facial breadth	Facial index, upper	Number of specimens	Orbits		
						Height	Breadth	Index
		<i>cm.</i>	<i>cm.</i>			<i>cm.</i>	<i>cm.</i>	
Southeastern Canada.....	(7)	7.8	14.1	55.2	(10)	3.47	3.96	87.8
Maine.....	(3)	7.4	13.45	53.2	(4)	3.36	3.9	86.2
Massachusetts.....	(8)	7.4	13.7	54.3	(10)	3.42	3.96	86.3
Rhode Island.....	(3)	7.4	13.35	55.5	(6)	3.5	3.9	90
Connecticut.....	(2)	.....	13.8	.....	(2)	3.25	3.8	84.6
New York State.....	(10)	7.4	14.05	51.7	(16)	3.4	3.9	86.8
Manhattan Island.....	(2)	7.95	(14.3)	(54.5)	(2)	3.47	3.97	87.4
Long Island.....	(4)	7.5	13.85	54	(5)	3.3	4	82.6
Staten Island.....	(3)	7.45	14.7	50.5	(3)	3.48	4	87.6
New Jersey (Heye collection).....	(7)	7.15	13.9	51.5	(7)	3.4	3.9	87.5
Maryland.....	.....	.....	.....	.....	(1)	(3.48)	(3.98)	(87.4)
Virginia (miscellaneous).....	(2)	7.5	14.7	51	(7)	3.55	4	88.9
Virginia (Valentine collection).....	(4)	7.3	13.85	56	(10)	3.33	3.8	87.9

XCIX. EASTERN INDIAN CRANIA: FACE (DETAILS)—Continued

FEMALES

Group	Number of specimens	Upper height	Facial breadth	Facial index, upper	Number of specimens	Orbits		
						Height	Breadth	Index
		<i>cm.</i>	<i>cm.</i>			<i>cm.</i>	<i>cm.</i>	
Southeastern Canada.....	(5)	6.75	12.6	52.9	(5)	3.38	3.78	89.5
Maine.....	(4)	6.8	12.95	52.7	(4)	3.28	3.81	86.2
Massachusetts.....	(15)	7	12.7	56.2	(21)	3.36	3.79	88.8
Rhode Island.....	(4)	7.1	13	55.2	(5)	3.45	3.87	89
Connecticut.....	(2)	6.85	12.3	55.7	(3)	3.32	3.6	92.1
New York State.....	(11)	6.9	13.1	52.9	(13)	3.35	3.8	88.6
Manhattan Island.....					(1)	(3.25)	(3.7)	(87.8)
Long Island.....	(4)	7	12.95	53.1	(5)	3.26	3.73	87.4
Staten Island.....	(2)	6.5	12.65	(51.6)	(3)	3.19	3.84	83
New Jersey (earlier).....	(11)	6.8	12.7	53	(13)	3.38	3.87	87.2
New Jersey (Heye collection).....	(5)	6.9	12.8	54.1	(7)	3.4	3.72	91.7
Virginia (miscellaneous).....					(2)	3.2	3.8	85.6
Virginia (Valentine collection).....	(5)	6.9	13.1	52.4	(6)	3.31	3.72	89

C. EASTERN INDIAN CRANIA: FACE (DETAILS)

MALES

Group	Number of specimens	Nose		Index	Number of specimens	Palate		
		Height	Breadth			Height	Breadth	Index
		<i>cm.</i>	<i>cm.</i>			<i>cm.</i>	<i>cm.</i>	
Southeastern Canada.....	(8)	5.46	2.7	49.1	(4)	5.8	6.8	117.3
Maine.....	(4)	5.1	2.3	45.6	(3)	5.8	6.6	113.8
Massachusetts.....	(10)	5.2	2.6	49.7	(5)	5.75	6.5	113.2
Rhode Island.....	(6)	5	2.65	52.5	(1)	(6)	(7.3)	(121.7)
Connecticut.....	(2)	5	2.45	49				
New York State.....	(15)	5.3	2.75	51.8	(2)	5.95	6.9	116
Manhattan Island.....	(2)	5.9	2.65	44.9	(2)	6.05	6.85	113.2
Long Island.....	(5)	5.3	2.47	46.7				
Staten Island.....	(3)	5.1	2.7	53.1	(2)	5.75	6.7	116.5
New Jersey (Heye collection).....	(7)	5.1	2.6	51.1	(8)	5.6	6.8	120.7
Maryland.....	(1)	(5.4)	(2.7)	(50)				
Virginia (miscellaneous).....	(3)	5.4	2.7	50.6				
Virginia (Valentine collection).....	(9)	5.23	2.74	53.5	(3)	5.9	6.7	114.1

C. EASTERN INDIAN CRANIA: FACE (DETAILS)—Continued

FEMALES

Groups	Nose				Palate			
	Number of specimens	Height	Breadth	Index	Number of specimens	Height	Breadth	Index
		<i>cm.</i>	<i>cm.</i>			<i>cm.</i>	<i>cm.</i>	
Southeastern Canada.....	(5)	5	2.67	53.4	(3)	5.3	6.1	115.8
Maine.....	(4)	4.9	2.45	50	(4)	5.6	6.4	113.8
Massachusetts.....	(21)	4.97	2.46	49.5	(8)	5.5	6.4	115.4
Rhode Island.....	(5)	5.14	2.68	52.1	(3)	5.6	6.5	116.1
Connecticut.....	(2)	4.75	2.6	54.7				
New York State.....	(13)	5	2.67	53.2	(1)	(5.5)	(7)	(127.3)
Long Island.....	(5)	4.9	2.3	49				
Staten Island.....	(3)	4.75	2.58	54.4				
New Jersey (earlier).....	(13)	4.87	2.5	51.5	(2)	5.2	6.3	121.2
New Jersey (Heye collection).....	(9)	4.98	2.63	52.9	(5)	5.25	6.35	120.5
Virginia (miscellaneous).....	(1)	(5)	(2.6)	(52)				
Virginia (Valentine collection).....	(6)	5	2.72	54.3	(5)	5.5	6.4	116.4

CI. EASTERN INDIAN CRANIA: FACE (DETAILS)

MALES

Group	Number of specimens	Diameter frontal minimum	Number of specimens	Basion-prosthion	Basion subnasal point	Basion nasion	Angle of facial prognathism	Angle of alveolar prognathism
		<i>cm.</i>		<i>cm.</i>	<i>cm.</i>	<i>cm.</i>	°	°
Southeastern Canada...	(14)	9.7	(5)	10.6	9.3	10.7	72	53
Maine.....	(6)	9.35	(1)	(10.4)	(9.1)	10.8	(75)	(55)
Massachusetts.....	(12)	9.5	(5)	10.4	9.2	10.7	73	58
Rhode Island.....	(6)	9.6	(3)	10.5	9.1	10.3	69	58.5
Connecticut.....	(4)	9.1	(2)			10.3		
New York State.....	(16)	9.5	(8)	10.5	9.4	10.6	71	54
Manhattan Island.....	(2)	9.5	(1)	(11)	(10.2)	11.2	(72.5)	(64)
Long Island.....	(1)	(9.3)	(4)	10.3	9.5	10.8	74	64
Staten Island.....	(2)	9.2	(3)	10.7	9.8	11.2	76	62
New Jersey (Heye collection).....	(8)	9.4	(6)	9.9	9	10.3	73	59
Maryland.....	(2)	9.9				(10.8)		
Virginia (miscellaneous).....	(12)	9.5	(1)	(10.2)	9.6	10.6	(74)	(60)
Virginia (Valentine collection).....	(14)	9.7	(1)	(10.2)	9.2	10.6	(71)	(54)

CI. EASTERN INDIAN CRANIA: FACE (DETAILS)—Continued

FEMALES

Group	Number of speci- mens	Diameter frontal min- imum	Number of speci- mens	Basion pros- thion	Basion sub- nasal point	Basion nasion	Angle of facial proгна- thism	Angle of alveolar proгна- thism
		<i>cm.</i>		<i>cm.</i>	<i>cm.</i>	<i>cm.</i>	°	°
Southeastern Canada.....	(4)	9.2	(3)	9.6	8.9	9.9	72	56
Maine.....	(6)	9.3	(3)	9.9	9.1	10.2	72	57
Massachusetts.....	(23)	9	(10)	10.1	9	10	71	56.5
Rhode Island.....	(4)	9.4	(2)	10.1	8.7	10.2	73	50
Connecticut.....	(3)	8.9	(2)	10.2	(8.5)	9.8	68	(51)
New York State.....	(13)	8.95	(11)	9.9	9	10.1	72.5	57.5
Long Island.....	(5)	9	(3)	10	(9)	10	71	(59)
Staten Island.....	(3)	9.2	(1)	(9.2)	(8.8)	9.9	(75)	-----
New Jersey (earlier).....	(7)	9.2	(4)	9.8	8.7	9.9	70	54
New Jersey (Heye collec- tion).....	(9)	9	(5)	9.6	8.6	10	74	57
Maryland.....	(3)	9.1	-----	-----	-----	(10.1)	-----	-----
Virginia (miscellaneous)....	(6)	9.1	-----	-----	(9.4)	(10.3)	-----	-----
Virginia (Valentine collec- tion).....	(18)	9.2	(5)	9.9	8.9	10.25	74	56

APPENDIX

One of the most important conclusions reached in connection with the studies dealt with in these pages is that of the physical identity of the Iroquois with the eastern Algonquian tribes. To test this conclusion the writer subsequently examined the valuable collection of Iroquois skeletal material in possession of the Buffalo Society of Natural Sciences,¹ consisting of 34 male and 22 female adult skulls, well identified and in good condition. The results of this additional study are given in the following tables and need little comment except that the conclusions presented in the body of this report as to the physical identity of the Iroquois and eastern Algonquian peoples are fully verified. In every respect the measurements and indexes of the new series fit closely among those of the other Eastern tribes, and in not a single feature do they drop out of line or even equal the extremes of variation in the skeletal remains of the tribes previously studied. In view of these facts the essential identity of the physical characters of the Iroquois and Algonquians, as determined by their skeletal remains, may, it seems, be regarded as definitely established.

IROQUOIS AND MOST NEARLY RELATED EASTERN INDIAN CRANIA

CRANIAL INDEX

<i>Male</i>			<i>Female</i>		
Connecticut	(4).....	72.4	Connecticut	(4).....	74.6
Maine	(6).....	72.7	Maine	(6).....	74.7
Massachusetts	(14).....	72.8	Massachusetts	(25).....	74.7
<i>Iroquois</i>	(34).....	73.1	<i>Iroquois</i>	(22).....	74.0
Southeastern Canada	(14).....	73.4	Southeastern Canada	.....
New York State	(19).....	73.5	New York State	(15).....	74.8
Maryland	(4).....	73.6	Maryland	(1).....	74.0
Rhode Island	(6).....	73.7	Long Island	(5).....	74.3
Delaware	(1).....	73.7	Delaware	.....
New Jersey (Munsee)	(4).....	73.9	Lenape	(19).....	75.1

HEIGHT-LENGTH INDEX

<i>Male</i>			<i>Female</i>		
Southeastern Canada	(14).....	73.1	Southeastern Canada	(5).....	75.7
Massachusetts	(12).....	73.5	Massachusetts	(24).....	75.5
Connecticut	(2).....	73.5	Connecticut	(3).....	74.9
New York State	(17).....	73.6	New York State	(14).....	72.5
<i>Iroquois</i>	(32).....	74.0	<i>Iroquois</i>	(21).....	74.4
Rhode Island	(6).....	74.1	Rhode Island	.....
New Jersey	(7).....	74.2	New Jersey	(20).....	74.4
Long Island	(5).....	74.9	Long Island	(5).....	73.2
Staten Island	(4).....	75.2	Staten Island	(3).....	73.9

¹ Grateful acknowledgment for courtesies in this connection are extended to Mr. Henry R. Howland, superintendent of the museum of this Society.

HEIGHT-BREADTH INDEX

<i>Male</i>			<i>Female</i>		
Southeastern Canada	(14).....	99.7	Southeastern Canada	(5).....	98.3
Connecticut	(2).....	100.4	Connecticut	(3).....	98.8
Rhode Island	(6).....	100.5	Rhode Island	(4).....	100.2
<i>Iroquois</i>	(32).....	101.0	<i>Iroquois</i>	(21).....	100.5
Massachusetts	(12).....	101.0	Massachusetts	(22).....	100.9
New Jersey (earlier)	(3).....	101.2	New Jersey (earlier)	(14).....	97.0
Virginia (all)	(17).....	101.8	Virginia (all)	(15).....	99.2

HEIGHT INDEX

(Hrdlička)

$$\frac{(H+B)+2}{L}$$

<i>Male</i>			<i>Female</i>		
Maine	(6).....	72.3	Maine	(5).....	74.1
Long Island	(5).....	72.8	Long Island	(5).....	74.1
Connecticut	(2).....	73.0	Connecticut	(3).....	74.7
Massachusetts	(12).....	73.2	Massachusetts	(22).....	75.1
Southeastern Canada	(14).....	73.3	Southeastern Canada	(5).....	76.3
Manhattan Island	(2).....	73.4	Manhattan Island	(1).....	73.7
Staten Island	(4).....	73.5	Staten Island	(3).....	74.6
New York State	(17).....	73.6	New York State	(14).....	73.7
<i>Iroquois</i>	(32).....	73.6	<i>Iroquois</i>	(21).....	74.2
Delaware	(1).....	73.7	Delaware	.....	.....
Rhode Island	(6).....	73.9	Rhode Island	(4).....	76.1
New Jersey (all)	(17).....	74.3	New Jersey (all)	(20).....	74.8

CRANIAL MODULE

<i>Male</i>			<i>Female</i>		
Rhode Island	(6).....	15.22	Rhode Island	(4).....	14.84
New Jersey (miscel.)	(4).....	15.33	New Jersey	(14).....	14.64
<i>Iroquois</i>	(32).....	15.41	<i>Iroquois</i>	(21).....	14.80
New Jersey (Munsee)	(7).....	15.44	New Jersey	(9).....	14.75
Virginia (Valentine coll.)	(11).....	15.46	Virginia (Valentine coll.)	(13).....	15.00
Southeastern Canada	(14).....	15.48	Southeastern Canada	(5).....	14.77
Maine	(6).....	15.55	Maine	(5).....	14.92
Connecticut	(2).....	15.55	Connecticut	(3).....	14.84
Massachusetts	(12).....	15.56	Massachusetts	(22).....	14.72

FACE: NASION-PROSTHION HEIGHT

<i>Male</i>			<i>Female</i>		
Massachusetts	(8).....	7.4	Massachusetts	(15).....	7.0
Rhode Island	(3).....	7.4	Rhode Island	(4).....	7.1
New York State	(10).....	7.4	New York State	(11).....	6.9
Staten Island	(3).....	7.45	Staten Island	(2).....	6.5
<i>Iroquois</i>	(22).....	7.45	<i>Iroquois</i>	(17).....	7.0
Virginia (miscel.)	(2).....	7.5	Virginia (miscel.)	.....	.....
Long Island	(4).....	7.5	Long Island	(4).....	7.0
Southeastern Canada	(7).....	7.8	Southeastern Canada	(5).....	6.75

DIAMETER BIZYGOMATIC MAXIMUM

<i>Male</i>		<i>Female</i>	
Rhode Island	(6)..... 13.35	Rhode Island	(3)..... 13.0
Maine	(2)..... 13.45	Maine	(4)..... 12.95
Massachusetts	(7)..... 13.7	Massachusetts	(8)..... 12.7
<i>Iroquois</i>	(24)..... 13.75	<i>Iroquois</i>	(17)..... 12.9
Connecticut	(2)..... 13.8	Connecticut	.....
Long Island	(4)..... 13.85	Long Island	(4)..... 12.95
Virginia (Valentine coll.)	(4)..... 13.85	Virginia (Valentine coll.)	(6)..... 13.1

ORBITAL INDEX

<i>Male</i>		<i>Female</i>	
Maine	(4)..... 86.2	Maine	(4)..... 86.2
Massachusetts	(10)..... 86.3	Massachusetts	(21)..... 88.8
New York State	(16)..... 86.8	New York State	(13)..... 88.6
<i>Iroquois</i>	(27)..... 87.0	<i>Iroquois</i>	(17)..... 88.5
Manhattan Island	(2)..... 87.4	Manhattan Island	(1)..... 87.8
Staten Island	(3)..... 87.6	Staten Island	(3)..... 83.0
Southeastern Canada	(10)..... 87.8	Southeastern Canada	(5)..... 89.5
Virginia (Valentine coll.)	(10)..... 87.9	Virginia (Valentine coll.)	(6)..... 89.0

NASAL INDEX

<i>Male</i>		<i>Female</i>	
Massachusetts	(10)..... 49.7	Massachusetts	(20)..... 49.5
Virginia (miscel.)	(3)..... 50.6	Virginia (miscel.)	(1)..... 52.0
New Jersey (Munsee)	(7)..... 51.1	New Jersey (Munsee)	(9)..... 52.9
<i>Iroquois</i>	(26)..... 51.7	<i>Iroquois</i>	(17)..... 51.9
New York State	(15)..... 51.8	New York State	(13)..... 53.2
Rhode Island	(6)..... 52.5	Rhode Island	(5)..... 52.1
Staten Island	(3)..... 53.1	Staten Island	(3)..... 54.4

DENTAL ARCH ("PALATAL") INDEX

<i>Male</i>		<i>Female</i>	
Virginia (Valentine coll.)	(3)..... 114.1	Virginia (Valentine coll.)	(5)..... 116.4
New York State	(2)..... 116.0	New York State	.....
<i>Iroquois</i>	(14)..... 116.2	<i>Iroquois</i>	(15)..... 114.3
Staten Island	(2)..... 116.5	Staten Island	.....
Southeastern Canada	(4)..... 117.3	Southeastern Canada	(3)..... 115.8

ANGLE OF FACIAL PROGNATHISM

<i>Male</i>		<i>Female</i>	
Rhode Island	(3)..... 69°	Rhode Island	(2)..... 73°
New York State	(7)..... 71	New York State	(10)..... 72.5
<i>Iroquois</i>	(17)..... 72	<i>Iroquois</i>	(15)..... 72
Massachusetts	(4)..... 73	Massachusetts	(3)..... 71
Long Island	(4)..... 74	Long Island	(3)..... 71

The preceding statements must not, of course, be regarded as implying any lessening of our interest in the Iroquois group. This large and important body of Indians was a complex of tribes, some of which, as yet, are represented but poorly in our collections, so far as their skeletal remains are concerned. It is possible that more abundant material will exhibit some differences between these tribes, owing to their varied earlier associations and perhaps to other agencies. In any event, the Iroquois are well worthy of further study, even though there may not be strong probability that the chief conclusion reached in this work, namely, their close physical relation with the Algonquians, can be seriously modified.

Much also remains to be done with respect to the Algonquians. The Canadian tribes have scarcely been touched as yet; there are numerous gaps in the skeletal collections from our Eastern states; and data on skeletal parts other than the skull in the principal tribes are very deficient.



CONTRIBUTIONS FROM
THE MUSEUM OF THE AMERICAN INDIAN
HEYER FOUNDATION
Volume IV, Number 1

THE TECHNIQUE OF PORCUPINE-
QUILL DECORATION AMONG
THE NORTH AMERICAN INDIANS

BY
WILLIAM C. ORCHARD

NEW YORK
THE MUSEUM OF THE AMERICAN INDIAN
HEYER FOUNDATION
10 EAST THIRTY-THIRD STREET
1916

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LANCASTER, PA.

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MUSEUM OF THE AMERICAN INDIAN

THE TECHNIQUE OF PORCUPINE-QUILL DECORATION AMONG THE NORTH AMERICAN INDIANS

BY

WILLIAM C. ORCHARD

INTRODUCTION

WHEN we consider the hardships connected with the primitive life of the North American Indians, particularly that of the wandering tribes of the great plains, it at first seems hardly possible that the women should have had either the inclination or the time to devote to elaborate embroidery; nevertheless there is abundant evidence of the fact that many hours have been spent on a single object in the desire to give expression to esthetic concepts. Examples of bead and porcupine-quill work attesting to the artistic ability of the Indians form a part of all well-known collections.

Porcupine-quill work is especially interesting by reason of the remarkably fine stitches that have been employed and the ingenuity displayed in the manipulation of the quills to produce effective designs. Indeed many specimens exhibit such skill as to be worthy of inclusion among the fine arts, where sewing and the selection of colors are important desiderata.

The purpose of this paper is to describe the technique and to attempt to bring about an appreciation of the complexity of the art of porcupine-quill work and the tireless patience that must have been exercised in producing such exquisite effects.

Specimens of the finest work were collected many years ago, and in most cases are without information as to their origin. However, comparison of technique and design with modern work, although vastly inferior, has furnished clues, so that the probable source of production may be given for those earlier and finer specimens.

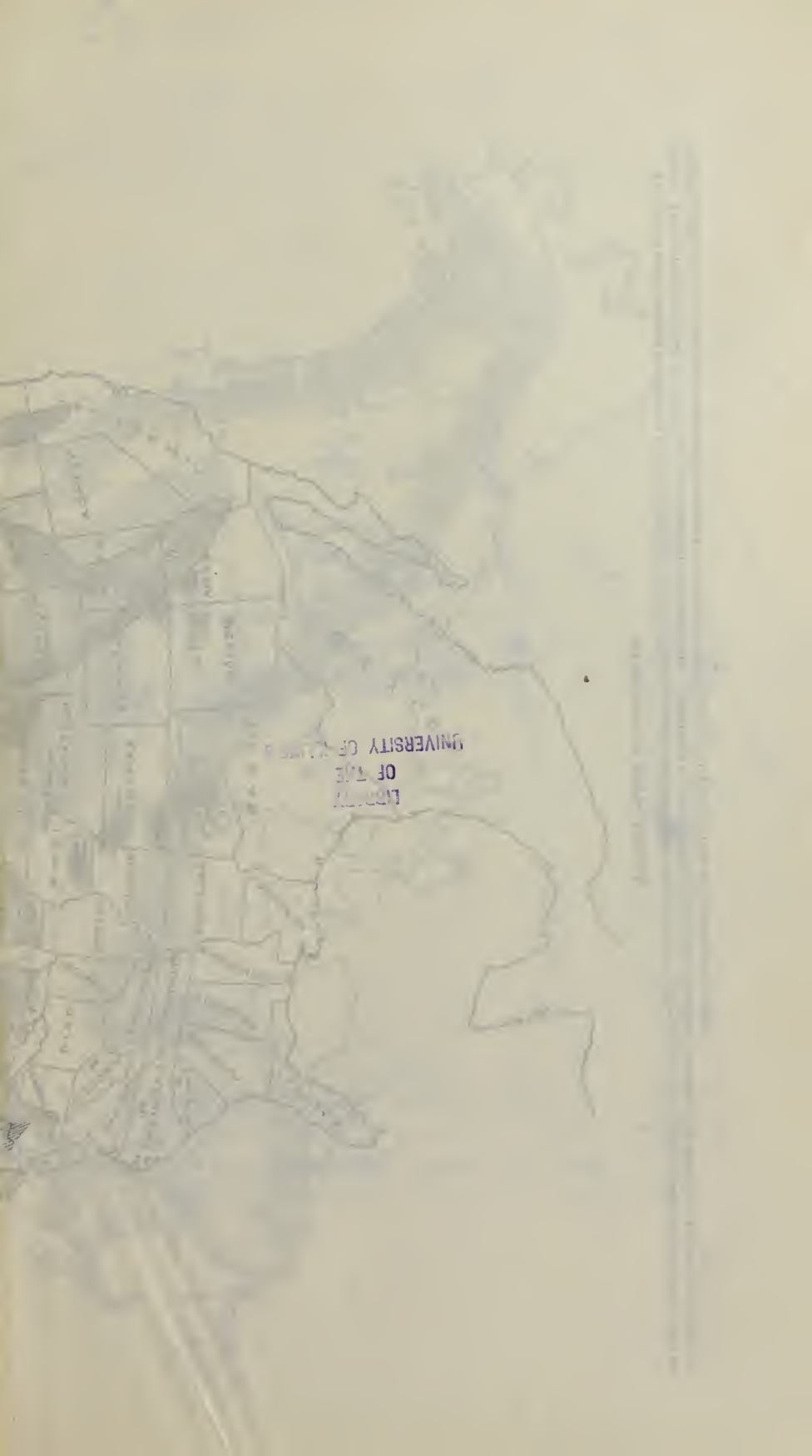
The drawings and explanations of the folding of the quills and stitches are chiefly the result of technical analyses. Some of the simple foldings have been demonstrated by modern workers. Only the constructive branch of the art will be considered.

Specimens have been collected from Alaska to Maine, including the woodland tribes and those of the great plains, and, as might be expected, they show conformity in design peculiar to the various tribes. The desire for designs of symbolic import stimulated the inventive genius of the artists, so that a remarkable number of complex foldings of the porcupine-quills and stitches have been devised.

Thanks are due to the officials of the United States National Museum at Washington, the American Museum of Natural History, New York City, and the Field Museum of Chicago, who kindly afforded facilities for the examination of their collections. The extensive collections of the Museum of the American Indian (Heye Foundation) in New York, generously placed at my disposal in connection with this study, have been of valuable assistance in furnishing all but two of the techniques described.

EARLY USE OF PORCUPINE-QUILLS

In the records of early explorers of North America occasional though somewhat indefinite references are made to the decorative art of the aborigines. Among the materials used as a means of decoration, porcupine-quills are frequently mentioned. Harmon, in his *Journal of Voyages and Travels in the Interior of North America*, writes: "The women manifest much ingenuity and taste in the work which they execute with porcupine quills. The colour of these quills is various, beautiful and durable, and the art of dyeing them is practised only by the females." In *Manners and Customs of Several Indian Tribes*, John D. Hunter mentions men's headdresses as being "neatly ornamented with feathers, porcupine quills, and horsehair stained of various colours . . . their waist-cloths, leggings, and moccasins, omitting the feathers, are decorated in the same manner as their caps." Other writers might be quoted who in a similar manner mention this particular form of decoration,





SKETCH MAP OF NORTH AMERICA

The dotted areas indicate the location of tribes which have produced porcupine-quill work and which were not living in those parts of the country where the porcupine might be found. The territory enclosed by cross-lines is the habitat of the porcupine. According to some old Sioux informants occasional hunting trips were made for the sole purpose of obtaining porcupine-quills, but more often quills were used as a medium of exchange by the people living in the porcupine country.

hence it is reasonable to suppose that porcupine-quill work is an art whose practice antedates the advent of people from the Old World and their influences on the arts of the American aborigines.

DISTRIBUTION

The porcupine has a widely distributed habitat in the northern part of the North American continent. Reference to the map (pl. II) will show the boundary-line extending from northern Labrador and across the southern shores of Hudson bay, northwesterly to beyond the Arctic circle in Alaska. The southern line includes New Brunswick, Nova Scotia, and Maine, thence follows a southerly trend into Pennsylvania, whence it turns toward the north and includes the Great Lakes region, pursues a northwesterly course to Alberta, there making a sudden turn toward the southeast, following the Rocky mountains and crossing the northwestern corner of Colorado and the southeastern part of Utah, through Arizona to the California line, there turning to the northeast, clearing Nevada and passing through Idaho, to British Columbia and Alaska. A narrow strip of territory extends toward the south, including the Cascade range, parts of the states of Washington and Oregon, and northern California.

A point of interest in connection with the habitat of the porcupine is the fact that this animal is not found in the country inhabited by those tribes which are today and have been in the past the producers of a great quantity of porcupine-quill embroidery. This may indicate that our Indian friends, like white people, desired the things most difficult to obtain for their personal adornment. On the other hand, Labrador and Alaska are included within the boundary, but the natives of those regions, excepting the Tlingit, have not contributed to the collections so far as can be learned.

BIRD-QUILL WORK

The Alaskan Eskimo, however, have made use of bird-quills, which, after being stripped of the rami, are split and the pieces woven into designs for belts. Figure 1 is an enlarged drawing of such a piece of work. It will be seen that the split quills are woven

over and under a series of warp strands, and edged with a strand along the face of the work, which is caught by another strand along the back, passing through between the quills at somewhat regular intervals and looping over the strand in front. The drawing indicates an alternation of colors, black and white. To effect this there is a double layer of quills, laid in series of threes or fours.

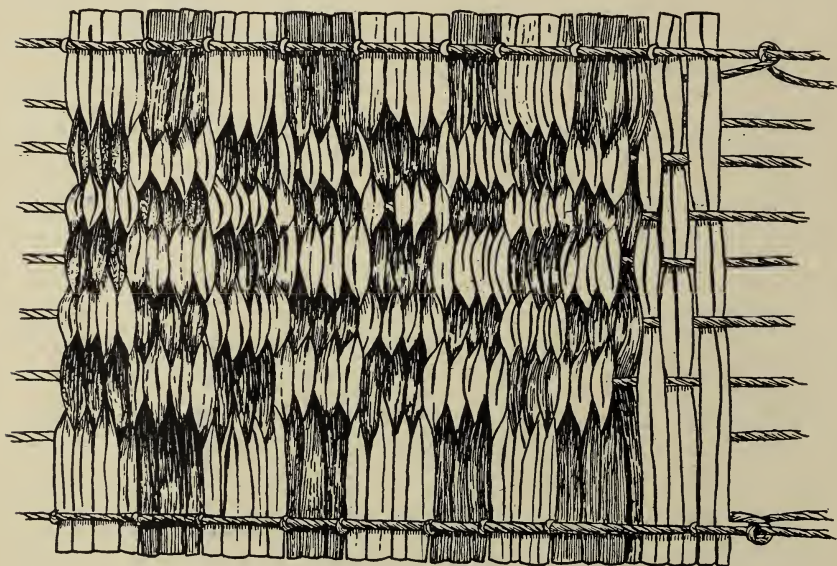
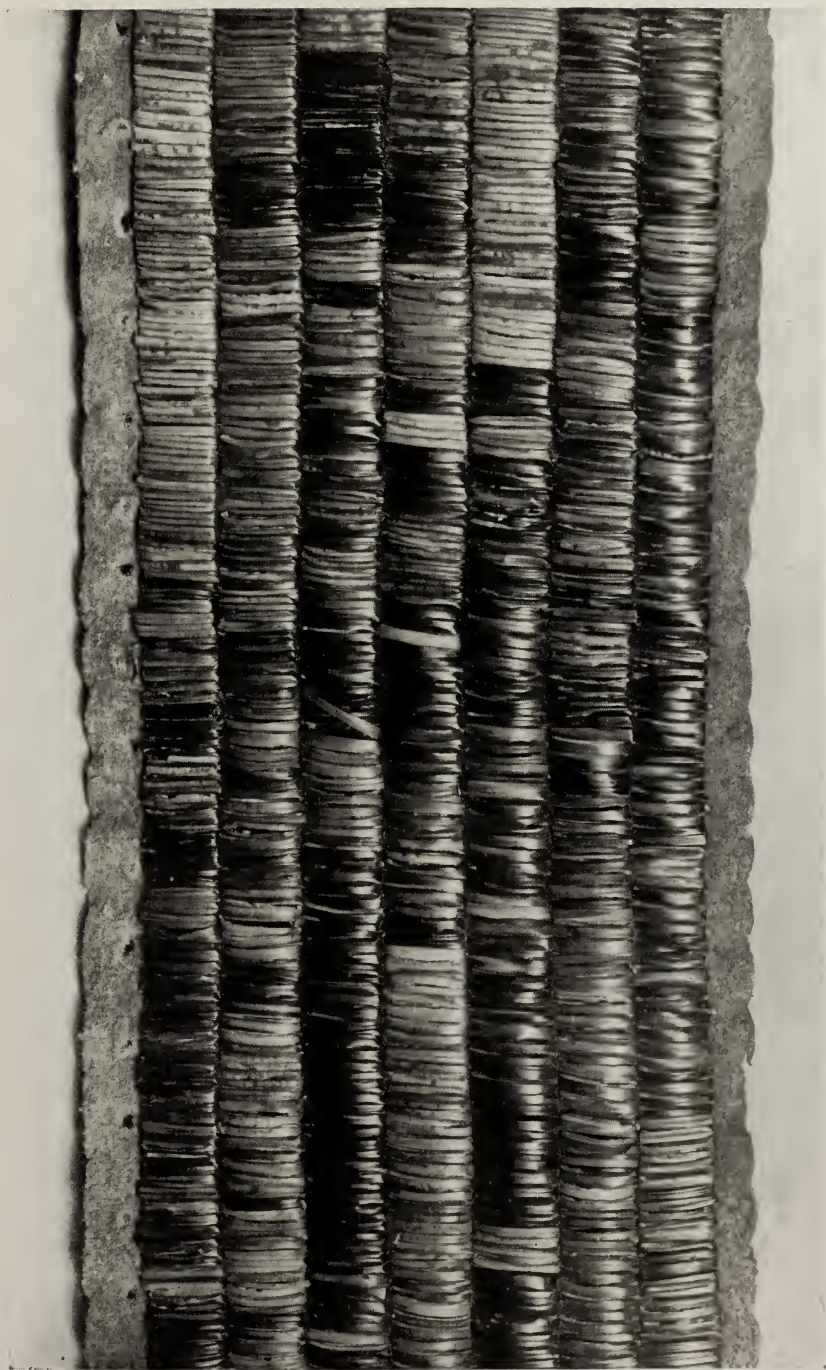


FIG. 1.—Bird-quill work of Alaskan Eskimo. (Enlarged.)

In the upper left-hand corner of the figure are four white quills, while black quills come to the front beneath them; still farther below the white quills are brought forward, and so on to the end. Although the lines are irregular, the effect is suggestive of the checker-board pattern. The finished weaving is sewed to a strip of leather, the edges of which are turned up and over the ends of the quills.

Bird-quills have been used to a small extent, either independent of, or in connection with porcupine-quills, by the North American Indians. Before discussing the technique of the art of porcupine-quill embroidery it may be well to introduce at this time a description of some of the pieces of bird-quill work that have been examined in connection with the preparation of this paper.



BIRD-QUILL DECORATION. HIDATSA
MUSEUM OF THE AMERICAN INDIAN

UNIVERSITY OF ILLINOIS

A split bird-quill is frequently found where an edging has been made, either on the extreme edge of a piece of leather that has been decorated, or surrounding a pattern that has not been worked out to the edge. In such cases the bird-quill has been used as a filler, that is, the porcupine-quills are wrapped around the bird-quill and then sewed to the leather, as shown in figure 48. In some instances, however, a strip of leather or a cord has been used for the same purpose, perhaps because the bird-quill was too stiff to produce the soft, graceful curves obtainable with other materials.

The best examples of work examined in which bird-quills have been used exclusively are to be found in the Museum of the American Indian. These consist of five pieces, $3\frac{3}{4}$ inches wide, the total length being 9 feet 4 inches (pl. III), and no doubt were intended to be used in a single long strip, in all probability as a decoration for a tipi cover. The method employed in fastening the quills is shown in figure 8. There are two objectionable features in the use of bird-quills, namely (1) the uneven, ragged appearance of the edges, due to splitting, which to a great extent mars the neatness that is so characteristic of the work in which quills of the porcupine are used; (2) they do not make a clean, sharp fold where they are turned under the stitches, hence the edges of the patterns are uneven and the whole presents the appearance of an inexpert piece of work, and to the stiffness may be due the absence of any form of decoration other than geometrical.

One or two instances have been noticed in which the two kinds of quills are used alternately in working bands of embroidery, and there are some examples in which grass has been employed in the same manner.

MATERIALS FOR PORCUPINE-QUILL WORK

During the summer of 1911 the writer made a hurried trip through the Sioux reservations in North Dakota and South Dakota, and a visit to the Ojibwa living near the shores of Georgian bay, Ontario, for the purpose of gathering all available information regarding materials and the various methods of preparing them, as well as of gaining an insight into the processes employed in the art of porcupine-quill work.

The designs were worked out mostly on soft tanned leather or on birchbark. An exception, however, is a woven technique which will be described. The tanning of leather or deerskin has been described by others, hence the necessity of here describing that process is obviated. The preparation of birchbark consists merely of shaping, perhaps splitting, and laying out the pattern to be worked. Hunting the porcupine fell to the lot of the men, and so far as could be learned, they sometimes plucked the quills from the living animal. One method of capture was to trace a porcupine up a tree by means of the freshly gnawed bark; the bow and arrow, or in later days a gun, was then used to dislodge it. Another method was to find a burrow that bore evidence of being inhabited, when the porcupine was dug out. A soft-tanned skin or a blanket was used to prevent escape. Various kinds of traps also were used.

Considerable attention was given to the sorting of the quills as they were plucked, which operation was performed without removing the skin. Four sizes of quills were found on the animal, and were graded accordingly. The largest and coarsest came from the tail, which were used in broad masses of embroidery, where a large surface was to be entirely covered, or for wrappings on club-handles, pipe-stems, and fringes. The next size came from the back, and still smaller quills from the neck. The finest were taken from the belly, and were used for the most delicate lines so noticeable in the exquisite work to be found in early specimens. The various sizes were kept in separate receptacles made from a bladder of an elk or a buffalo. After the quills were all plucked, the hair was singed from the body and the animal was cooked entire, being a highly esteemed delicacy.

DYE MATERIALS AND DYEING

The selection of materials used for coloring was governed to a great extent by the locality in which the work was to be done, although sometimes long journeys were made to procure choice materials to serve as ingredients for making dyes.

Since the introduction of aniline dyes very little use has been made of the native products, consequently present information

respecting the old methods is sometimes vague, and early writers refer but little to the subject. From Maximilian¹ we learn that among the Blackfeet, "to produce the beautiful yellow colour, they employ a lemon-coloured moss from the Rocky Mountains, which grows in the fir trees. . . . A certain root furnishes a beautiful red dye, and they extract many other bright colours from the goods procured from the Whites. With them they dye the porcupine quills and the quills of the feathers, with which they embroider very neatly." The Cree women, according to the same author,² "understand how to dye a beautiful red with the roots of *Galium tinctorum* and *boreale*, and black with the bark of the alder."

Harmon,³ writing of the Indians living east of the Canadian Rockies, furnishes a little more detailed information: "To colour black, they make use of a chocolate coloured stone, which they burn, and pound fine, and put into a vessel, with the bark of the hazel-nut tree. The vessel is then filled with water, and into it the quills are put, and the vessel is placed over a small fire, where the liquor in it is permitted to simmer, for two or three hours. The quills are then taken out, and put on a board, to dry, before a gentle fire. After they have been dried and rubbed over with bear's oil, they become of a beautiful shining black, and are fit for use. To dye red or yellow, they make use of certain roots, and the moss which they find, on a species of the fir tree. These are put, together with the quills, into a vessel, filled with water, made acid, by boiling currants or gooseberries, &c., in it. The vessel is then covered tight, and the liquid is made to simmer over the fire, for three or four hours, after which the quills are taken out and dried, and are fit for use, . . . and these colours never fade."

As a result of many inquiries made of the old people on the Sioux reservations in North Dakota and South Dakota, it was learned that native materials for dye-making were plentiful and varied in the old days. After numerous and extended talks with groups of the older members of the tribes, some interesting notes

¹ Maximilian, Prince of Wied, *Travels in the Interior of North America*, 1832-34, Thwaites ed., pt. II, pp. 103-104, Cleveland, 1906.

² *Ibid.*, p. 13.

³ *A Journal of Voyages and Travels*, pp. 377-378, Andover, 1820.

on the old-style method of dyeing were obtained, and in some instances the materials were produced for identification. There is a possibility, however, that some of the details of the dyeing processes are forever lost.

The buffalo-berry and squaw-currant were used for producing a red dye, but the former was preferred because it is more succulent than the squaw-currant, which has a large seed with a thin skin and consequently required a greater quantity to produce the desired color. The operation of dyeing consisted simply of boiling the fruit and porcupine-quills together in water until the required color was obtained. Sometimes dock-root was used in addition to the fruit, because it produced a brighter and stronger color. Care was exercised in collecting the root, as the "mother," not the "father" plant, must be used; the difference between the two plants was recognized by the flowers.

Wild grapes were used for making black dye of superior quality, while a good substitute was found in hickory or walnuts when grapes were not obtainable. The nuts, gathered green (that is, before the hard shell had formed), were laid in the sun and occasionally sprinkled with water until they turned black, and then were boiled in water with the quills. The resultant color was a brownish-black, and consequently was not so satisfactory to the discriminating artist as that produced by the grapes.

Wild sunflower and cone flower (*Ratibida columnaris*) were used for producing yellow dye. The petals, with pieces of decayed oak-bark or the roots of cattail, were boiled in water with the quills. The bark of a certain pine tree "found only in the Black Hills" is said to have been another medium for producing yellow dye.

Blue dye seems to have been unknown, at least among the Dakota Indians, in the early days. After the introduction of aniline colors, however, blue came into use, and later, when the Government issued blankets to the reservation Indians, a piece of an old blue blanket was boiled with the quills to produce that hue.

Among the Ojibwa of Georgian bay it was learned that tamarack bark produced a red dye of medium shade, and that a darker color was obtained by using spruce-cones. Another shade of red was



SIOUX QUILL-WORKER'S TOOLS AND QUILL POUCH (*a, b*, AWLS; *c*, BONE MARKER)
MUSEUM OF THE AMERICAN INDIAN



PORCUPINE-QUILL FLATTENER. SIOUX
MUSEUM OF THE AMERICAN INDIAN

obtained from sumac berries. Yellow dye was made from the roots of black willow, but a much brighter yellow was obtained from fox moss, *Evernia vulpina*, which was rarely used because difficult to procure. The inner bark of hemlock produced a brownish-red, but apparently was not considered a good color by the old people. Blueberries afforded a color approaching purple. Larkspur was spoken of as having been used to produce pale blue.

These few notes on dye materials were collected from four very old people, but it was not possible to obtain any details other than that the quills were boiled in concoctions made from the various products mentioned.

IMPLEMENTS USED IN QUILL-WORK

The modern artist's outfit (pl. IV) is not very extensive, consisting merely of a pouch for holding the quills, a bone marker for tracing the design on the leather or birchbark, some awls, a bunch of sinew strands, and a knife. Sometimes a pair of scissors may be found in a modern outfit, but rarely a commercial needle or a thimble. It is safe to say that nearly all the modern quill-workers still use an awl and sinew without a needle to perform their work.

There is no reason to believe that the quill-workers of earlier days possessed anything more elaborate in the way of tools, unless an exception may be made of the quill-flattener, of which there are a few in existence, decorated with elaborate carvings as illustrated in plate v. It is not certain, however, that such an implement was used commonly to flatten the quills, as it is so much easier and more practical to meet that need of the process by simply holding one end of the quill between the teeth and drawing the thumb-nail, tightly pressed, lengthwise of the quill—the method used by present-day quill-workers. Aside from this, the so-called quill-flatteners are large and somewhat cumbersome (the specimen illustrated is 14 inches long), hence their use would result in a loss of energy, if not of time, when it is considered that each quill is flattened immediately before it is used, because it would be necessary to take up and lay down the instrument many times during a day's work. Some quill-flatteners are made of bone, others of antler. A few

other objects may be found in a workbag, such as a whetstone, perhaps some patterns, and many trinkets that may not be necessary to the work in hand.

A thread of sinew was used for sewing the quills to the leather. The fiber of which this thread was made was stripped from the large tendons along each side of the backbone of the buffalo or deer. The raw tendons were dried and shredded, and sometimes twisted into hanks ready for use. A suitable strand being selected, it was moistened, one end pointed by twisting between the thumb and forefinger, and then allowed to dry. A point so treated would easily follow an awl-hole in the leather. The other part of the thread was kept soft and moist by occasionally applying saliva with the finger-tips.

This item of information was furnished by an old woman at Pine Ridge, South Dakota. Doubtless the same method of preparing and using sinew thread was employed by the early quill-workers.

James Adair, in his *History of American Indians*, says: "The needles and thread they used were fishbones, or the horns and bones of deer rubbed sharp, and deer sinews, and a sort of hemp that grows among them spontaneously in rich, open lands."

Designs were laid out with the aid of cut patterns, sometimes made of rawhide or birchbark, or were drawn freehand. The marker, a thin, flat piece of bone, three or four inches long by one inch wide, with smooth, rounded edges, was used as a pencil to follow the cut pattern, or, without such guide, was dipped in a dark-colored fluid, or the marks were made by simply rubbing the edge of the bone on the leather, which left a mark not easily erased. In this part of the work the women oftentimes were aided by suggestions from the men.

Material for making a "dark-colored fluid" was collected on the Pine Ridge reservation, South Dakota, and is part of a very old painting outfit which consists of bone marker, pieces of wedge-shaped bone pith used for applying the color, and various earth colors, including a fine, soft, black powder, described as being "mud from a river-bottom a long way off to the northwest." Ac-

cording to my informant, many years ago this black mud was obtained by trading with the Indians from the northwest, and was in great demand for marking out patterns and for picture-writing on skins. A solution was made by mixing the dried mud with water. Sometimes a small quantity of blood was added as a binder.

STITCHES

Several kinds of stitches are used in fastening the quills to the leather, which for convenience in description I have named as follows:

Spot-stitch—The first and most simple is spot-stitch (fig. 2). In the drawing it will be seen that the sinew thread passes straight ahead, and is spotted through the surface of the leather at regular

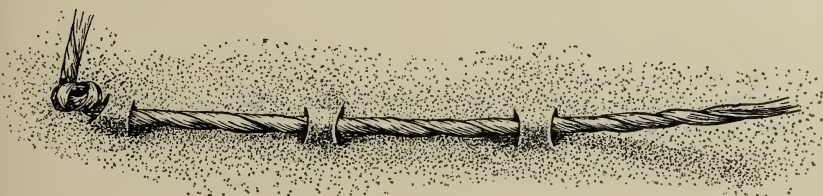


FIG. 2.—Spot-stitch.

intervals, the exposed part of the sinew forming a loop which holds the quill. It can easily be seen that such a stitch can follow a curved line.

Back-stitch—The second I have designated back-stitch (fig. 3). In this case, in sewing from left to right, the awl is thrust through the surface of the leather with the point inclined toward the left and pointing upward. When the sinew is drawn tight, the fibers of the leather are caused to twist and grip the sinew, so that the stitch cannot slip. The stability of this stitch was apparently fully realized by the Indian artist, as it is found in most of the specimens of early work, and is used to some extent by recent workers.

Loop-stitch—The third may be called a loop-stitch (fig. 4). An incision is made through the surface of the leather by pointing the awl upward. The sinew is passed through the opening in the same direction as the awl was made to take, then made to cross itself

and passed on to the next incision, when the operation of passing through the leather and crossing is repeated. It may be understood from the drawing that a stitch so formed with a moistened

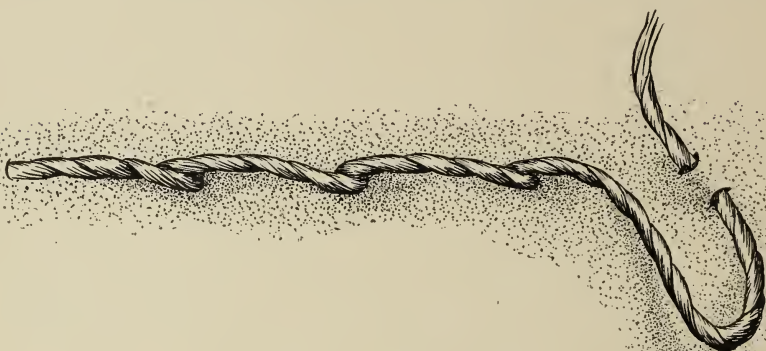


FIG. 3.—Back-stitch.

sinew thread, when pulled tight, cannot possibly slip, but makes a firm and lasting stitch.

A remarkable feature in porcupine-quill work is that even in the very oldest specimens examined the stitches had rarely pulled out, although the quills may have been worn away and perhaps

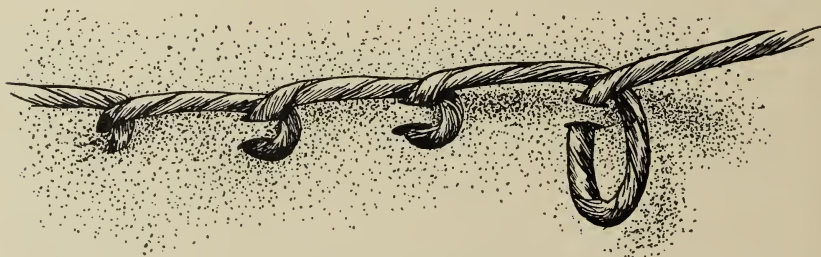


FIG. 4.—Loop-stitch.

the exposed sinew had worn off, but the ends still held fast in the leather.

A point of interest in connection with the sewing, which will be well to emphasize at this time, is the fact that the stitches were never carried through the leather from back to front, but were

caught only under the surface, even when very thin deerskin was used. The reason given for this, by an old woman on the Crow Creek reservation, who at the time of my inquiry was embroidering a large pouch, was, "that it is hard to guess where to push the awl through from the under side without turning the piece of leather over." There is no doubt that the position for the stitch can be more readily found by working from the upper side, especially where a large surface is being decorated. Also a much finer stitch can be made when the thread is passed through the surface only. Sometimes a knotted end of the sinew may be found on the reverse side.

SPLICING

Owing to the shortness of porcupine-quills, it became necessary to formulate a system of splicing, or inserting additional quills, in such manner that the ends should be secure and concealed. A common method seems to have prevailed among all quill-workers. To facilitate the explanation of the numerous techniques employed in the art of quill-work, the splicings will be described at this time; and unless otherwise stated it may be understood that these methods have been made use of in the work hereafter to be treated.

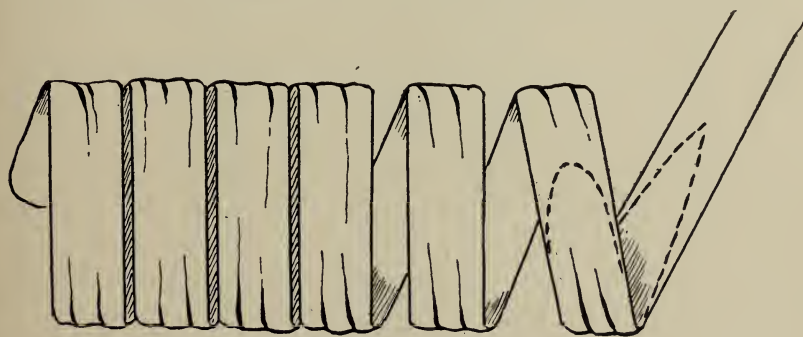


FIG. 5.—A method of splicing.

A very simple though effective splice, illustrated in figure 5, is made use of in a majority of the techniques. As the drawing shows, when the end of a quill has been reached in embroidering, a new quill is added and secured by laying its point inside the fold of the last quill, where a stitch is made across the overlapping

extremities. The dotted lines in the drawing indicate the positions of the two ends. This splice has remarkable holding quality, in

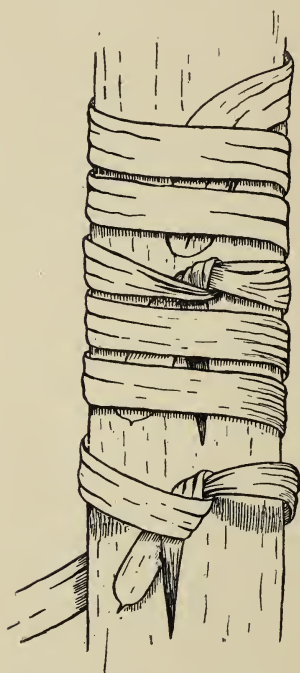


FIG. 6.—A method of splicing.

some measure due to the fact that the quills were moistened and flattened when being used, thus rendering them soft and pliable; after they became dry they were stiff and could not change their position.

This splice has been employed in the braiding used for pipe-stems, etc., described in connection with figures 32 and 33.

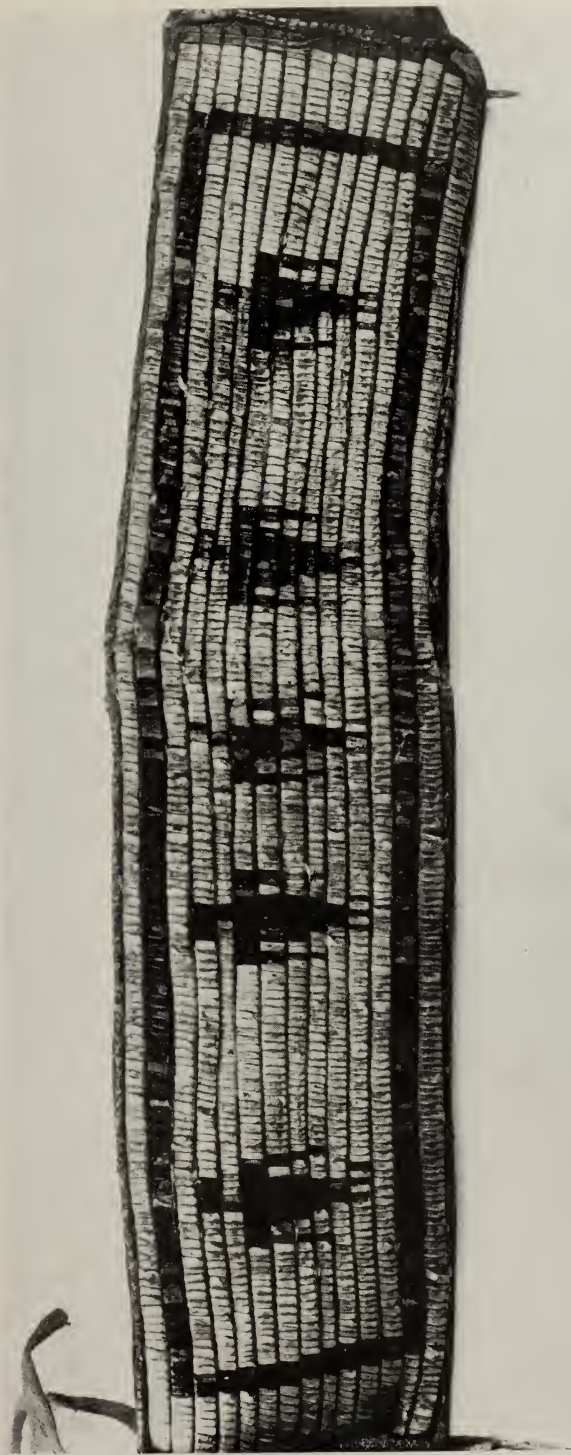
In making a splice where a strand of fringe or some slight object has been wrapped with porcupine-quill, the two ends were twisted and turned under the wrappings (fig. 6). Such splices are always found on the back of the object so decorated, or as much out of sight as possible, the front or better side showing a continuous and even wrapping.

One other method has been observed, although not a very common one, which may be called "telescoping," that is, the point of an added quill has been thrust into the end of the preceding one (fig. 7). This mode of splicing has been found only where unflattened quills have been used.

Of the various methods employed in fastening the quills to leather, where broad masses of solid embroidery are desired, the most simple form seems to be that shown in figure 8. As may be seen in the drawing, the spot-stitch is here used. The quills are held in place by two rows of stitches, the sinew thread being caught into the surface of the leather between each fold of the quills. Such



FIG. 7.—
Splicing by
"telescoping."



ARM-BAND FROM SAUK AND FOX WAR-BUNDLE
MUSEUM OF THE AMERICAN INDIAN

bands of embroidery vary in width from one-eighth to five-eighths of an inch, or in rare instances to three-quarters of an inch, and are worked side by side until the desired area is covered.

Should the space to be decorated be other than square or rectangular, as for instance the toe of a moccasin, the lines of stitches



FIG. 8.—Method of fastening quills to leather.

and folds of the quills converge, so as to conform to the shape of the area. By the use of contrasting colors, geometrical designs have been worked out. In some instances the effect has been elaborated by a widening or contraction of the rows of quill-work. An interesting addition to this method has been noted on some recent Hidatsa work (fig. 9), in which stitches have been made along the center of the rows or bands of quill-work over the surface. As

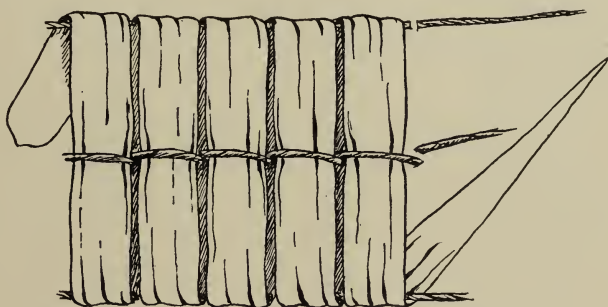


FIG. 9.—Hidatsa quill-work with stitches along center.

the bands are not so wide as to demand such sewing for strength, it is probable that additional ornamentation was the object in view. The extra stitch is the back-stitch.

According to observations made among modern quill-workers, it was found that such bands of quills were worked from left to

right. The lines of the bands having been drawn on the article to be decorated, a sinew thread is made fast at the respective starting points of both rows of stitches; a quill is then laid in the first position at the top of the band, a stitch is made over that end, and the quill is turned over the stitch, when another fold is made at the proper distance to conform to the width of the band. The sinew thread at the lower line is now passed through the fold and caught into the surface of the leather as close to the quill as it is possible to get it.

It will be seen from the drawing (fig. 8) that in the last mentioned folding, at the bottom of the band, the quill is folded under itself, and then passes on diagonally across the band to the next position at the top, where another fold and a stitch are made. The distance between the folds has been exaggerated in the drawing in order to show the movement of the quill, which if drawn correctly would be obscure.

There are a number of instances in which a strip of rawhide has been used as a filler, that is, the quills have been wrapped around the strip, and the stitches made in the usual place where the folds in the quills have been made, as shown in figure 10. This method seems to have been used to some extent by the Haida and

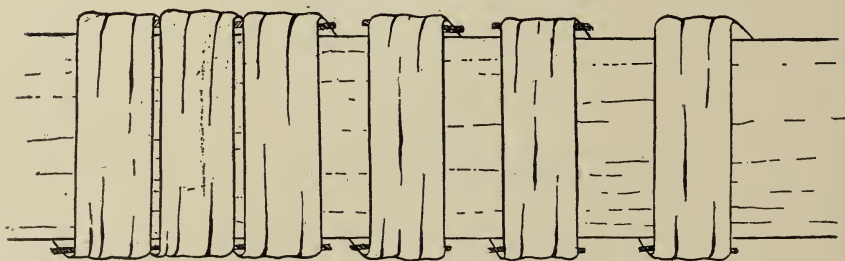
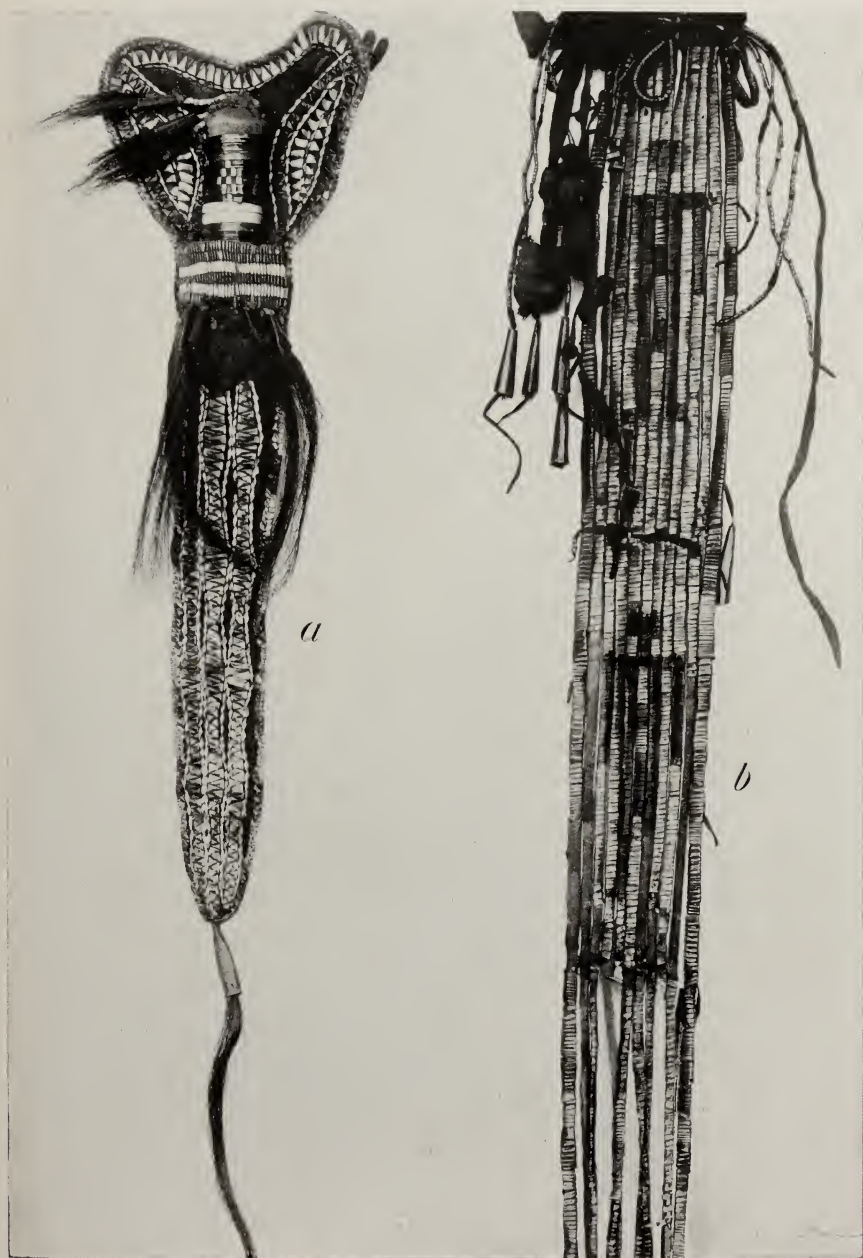


FIG. 10.—Strip of rawhide used as a filler for quill-work.

Tsimshian. A specimen of the same technique, however, has appeared on an arm-band in a very old war-bundle collected from the Sauk and Fox Indians, illustrated in plate VI.

In consequence of having the strip of rawhide under the quills, the work does not have that close, compact appearance so noticeable when the strip has not been used. The arm-band has been further ornamented with an elaborate fringe fastened to one end, com-



KNIFE-SHEATH. DELAWARE

FRINGE OF ARM-BAND. SAUK AND FOX

MUSEUM OF THE AMERICAN INDIAN

posed of eleven strips of rawhide wrapped with porcupine-quills in the manner described for figure 6. The fringe was originally decorated with three, perhaps four, human figures. The design is produced by the introduction of various colored quills at measured intervals. The figures are about three and one-half inches long, and in the center of each body a short wrapping of bird-quill has been applied.

Plate VII, *b*, illustrates a section of the fringe showing two figures; there are indications of the third, but the condition of the specimen is such that the presence of a fourth figure is not at all certain. The specimen is a well-executed piece of the decorated fringe technique.

Although the spot-stitch is so simple, it does not appear to have been used so commonly as the back or loop stitches, and in all probability the better holding quality of the two last named stitches was fully appreciated. A majority of the specimens of quill-work examined, in which bands of embroidery have been used, show the use of the back-stitch or loop-stitch; and sometimes both stitches have been used on one band, that is, the top edge is held by the loop-stitch while the lower is held by the back-stitch.

The modern quill-workers have introduced another thread in connection with these bands of embroidery, one which I have been

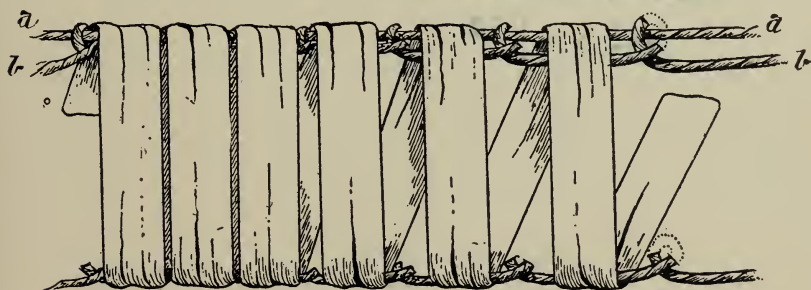


FIG. 11.—Quill-work showing an additional thread.

unable to find in any of the old specimens. In figure 11 the added thread is marked *a*. The loop-stitch is always used with it, and the additional thread is employed only along the top edge of the band. In connection with this, a fact to be noted is that I have

never found anything but a commercial thread used for that marked *a*.

The illustration shows the two threads *a* and *b* starting off together at the upper edge of the band, after being knotted into the leather. A turn of the quill is made, and then follows a loop-stitch by thread *b* through the leather and over thread *a*. At the lower edge a stitch and a fold of the quill are made, when the first operation at the upper edge is repeated, and so on until the band is completed. While the sewing is proceeding, the thread *a* is kept taut by having the end not fastened to the work wrapped around a small stick which is tucked into the quill-workers' moccasin. Being thus held, the thread can be tightened or slackened as required.

No satisfactory explanation of the function of the extra thread could be obtained from the many quill-workers with whom I came in contact. One woman explained that by drawing the thread tight under the fold, "it made the quill lay flat and close to the leather." Another said, "That is the proper way to do the work;" still another explained that "it was only a fashion," and that just as good work could be done without the extra thread. This last statement is a truth which may be well substantiated by comparing modern work with specimens of earlier days. The use of the additional thread is found not only in broad bands making up solid masses of embroidery, but is invariably made use of in narrow bands such as is shown in plate VIII, which illustrates a small calfskin with nineteen bands of embroidery, each band one-eighth of an inch wide, every one of which is sewed to the skin with two rows of stitches including the linear thread. It may be readily understood that a great amount of patience must have been exercised in performing such work.

Figure 12 illustrates an entirely different effect, produced by a change in the method of folding the quills. Compared with figure 8 it will be seen that the quill coming from the upper edge passes under the stitch at the lower edge of the row, and, crossing diagonally to the upper edge, passes under the stitch at that point, then turning over itself toward the lower edge, makes an interlocking saw tooth pattern, instead of the parallel bars shown in figure 8.



CHILD'S PUBERTY ROBE. SIOUX
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IROQUOIS MOCCASIN

SIOUX MOCCASIN

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An interesting variation of this process is illustrated in figure 13. As the drawing shows, two quills have been used, the diagonal crossings extended and the quills overlapping those crossings alternately. The folding is practically the same as that shown in figure 12, but the overlapping of the added quill has produced a

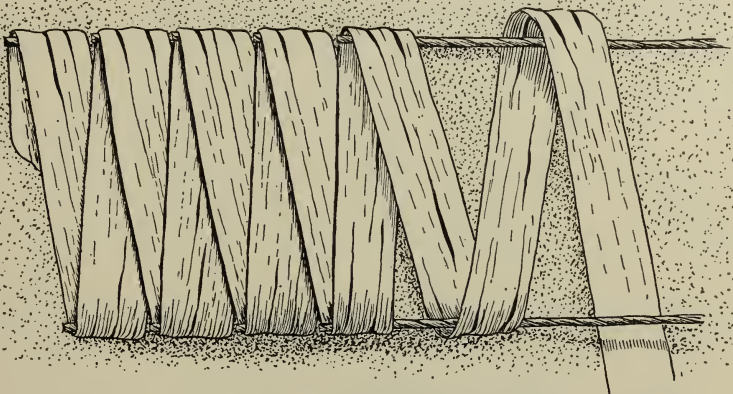


FIG. 12.—A method of folding the quills.

surface pattern of entirely different appearance. A striking effect is produced by the use of quills of contrasting colors.

The methods of folding illustrated by figures 8, 12, and 13, are those used in single-band decoration or in covering broad surfaces. Designs are introduced by the use of variously colored quills or by

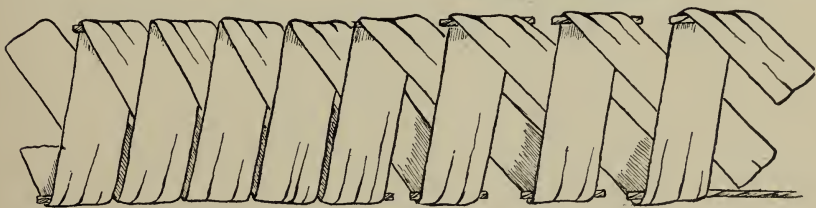


FIG. 13.—A method of folding the quills.

changing the position and the widths of the rows. The designs produced by this technique are of a geometrical nature, a good example of which is shown in plate IX.

An intricate method of crossing and folding is shown in figure 14, the details of which may be clearly traced. The specimens on

which this technique occurs consist of two snake-skins, found in an Iowa war-bundle. They are decorated on one side only, and but a short length of the surface is covered. Three rows of the quill-work were laid side by side (the drawing shows only two). Red and yellow quills were used, and so folded that the yellow quills form a diamond-shaped pattern across the whole embroidery, the red quills producing a smaller diamond enclosed in the yellow pattern. The drawing shows the quills spread apart abnormally, but when drawn close together a solid, well-defined pattern is the result. Spot-stitches are looped through the turn of the quills

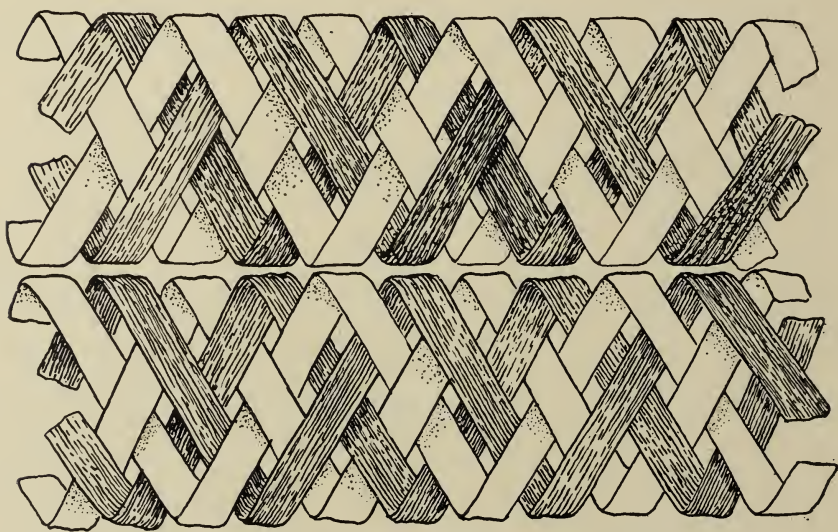


FIG. 14.—An intricate method of crossing and folding.

at each fold along the edges of the row, and splices are made in the usual manner. A section of a decorated snake-skin is shown in plate x. The design suggests the natural markings of the skin.

Other methods of covering large surfaces are shown in figures 15 and 17. In figure 15 is introduced a technique similar to the checker weave of basketry, consisting of two elements crossing each other at right angles, one over and one under. This form of decoration is found usually where rectangular or square areas are covered. The arrangement of the quills in this technique precludes



SECTION OF A QUILL-DECORATED SNAKE-SKIN FROM AN IOWA WAR-BUNDLE
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the possibility of working out designs to any extent; however, some attempt has been made by using quills of different colors. The quills are held in place by spot-stitches around the edges of the decorated area, where the ends of the quills are turned under, indicated by dotted lines in the drawing. Sometimes the width of

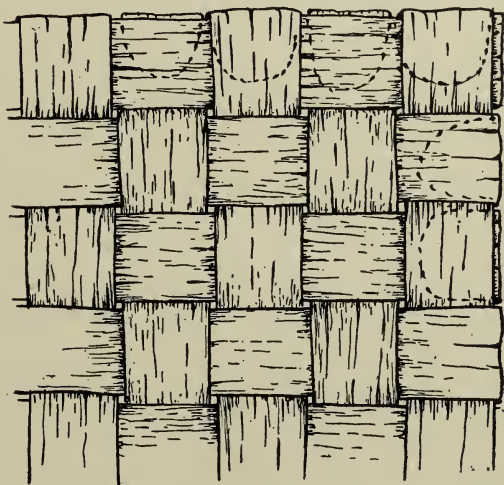


FIG. 15.—The "checker-weave" method of covering large surfaces.

the area has proved to be greater than the length of a quill; in such cases the ends and points of added quills are concealed under crossing elements. An example of this work is shown in plate XI. The specimen illustrated is a section of a decorated legging of Blackfoot origin.

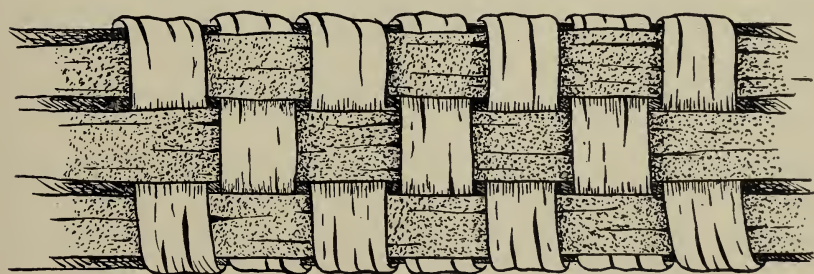


Fig. 16.—Another form of the "checker-weave."

A wrapping of the same technique is found on strips of rawhide about one-quarter of an inch in width (fig. 16). In this case no

stitches are used to keep the quills in place; instead, the ends of the crossing elements are twisted together at the back of the rawhide strip, as shown in figure 6, while the ends of the quills laid lengthwise are held in place by wrappings of sinew at the extremities of the rawhide strip. Splicing is accomplished by overlapping the ends of the quills, which are secured and concealed by the crossing elements. The form of decoration here described has been applied to the entire length of an eagle-feather, fastened to the quill, and worn as a scalp ornament of Osage origin.

Figure 17 illustrates what may be called a plaiting, where two elements cross each other obliquely over and under, forming a

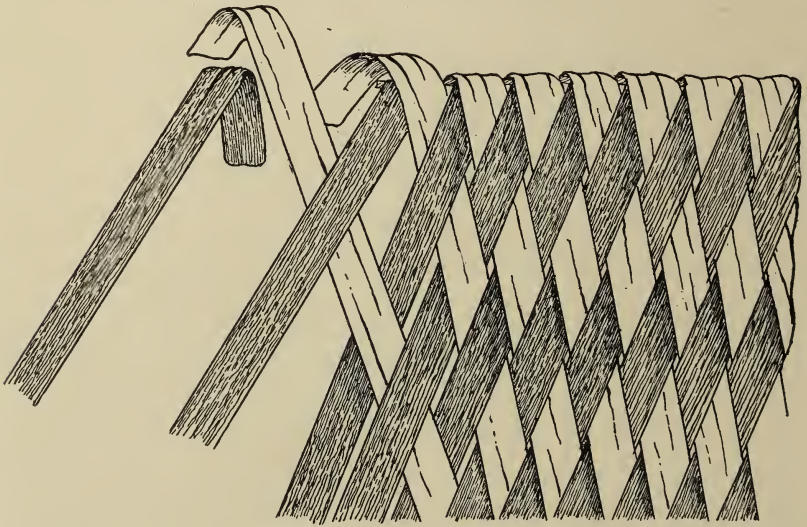


FIG. 17.—The plaiting method.

diamond-shaped pattern. The quills are held in position by spot-stitches around the edge, and, when necessary, across the decorated area where that is wider than the length of a quill. This technique has been found in broad patches (from seven to ten inches wide) on pipe-bags and baby-carriers. The same method of splicing as described in the preceding technique is employed.

Little opportunity is given for working out designs other than those that are strictly geometric. A very pleasing effect of this



SECTION OF BLACKFOOT LEGGING
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DECORATION ON A CHEYENNE SHIRT
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technique is produced by the working of narrow bands (fig. 18) side by side, an example of which may be seen on plate XI, above and below the checker weave on the section of Blackfoot legging. The drawing shows the use of two quills which are made to cross

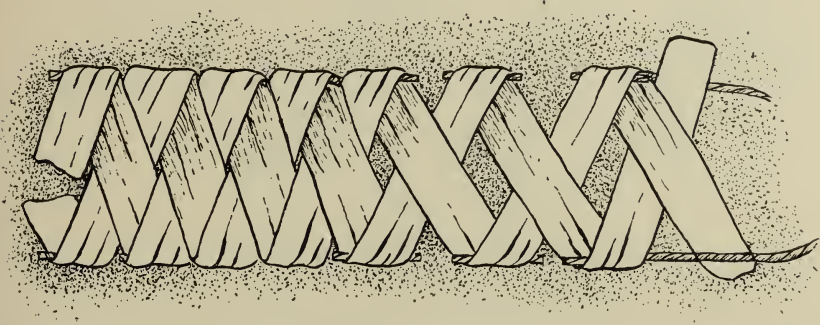


FIG. 18.—Technique produced by working narrow bands.

each other diagonally, forming a single diamond pattern in the center of the band. Figure 19 shows, by the addition of a third quill, how a double-diamond effect is produced. This is illustrated in the long, pointed pattern on plate XII.

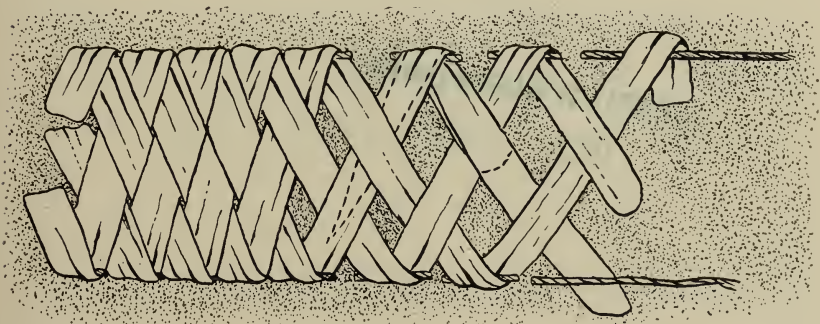


FIG. 19.—Double-diamond effect produced by the addition of a third quill.

An entirely different effect is produced in the appearance of a narrow band (fig. 18) by introducing quills of contrasting colors. For example, in figure 20 black and white quills are shown, with exactly the same folding as used in figure 18, resulting in black and white lines running diagonally across the band. This variation

occurs frequently and unless closely examined has the appearance of being a different technique. Examples of it are shown in plate XVIII.



FIG. 20.—Effect produced by using black and white quills.

Figure 21 illustrates an unusual method employed for bringing together two quills of contrasting colors; in fact it is the only specimen I have found in which two quills have been used one on top of the other. A white quill is backed with a black one; then the two are worked along together and folded in such manner that first a white surface is exposed, then, crossed by another fold, a black surface is presented, the whole producing a sawtooth pattern.

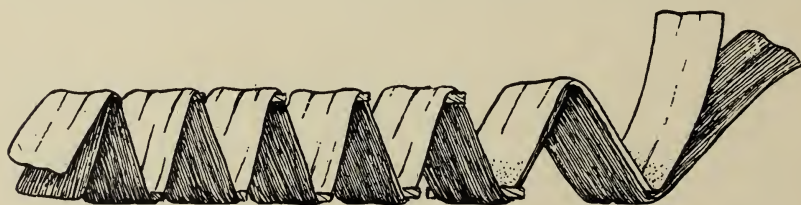


FIG. 21.—Use of superimposed quills of contrasting colors.

This interesting technique occurs on a knife-sheath collected many years ago from the Delaware Indians; it was recently found in Europe, and has since been added to the collections of the Museum of the American Indian. The sheath is made of black tanned deerskin, and is profusely although rather crudely decorated with porcupine-quills. The specimen is shown on plate VII, *a*. The technique referred to may be seen at the top, on the broad part, behind the knife handle.

Figure 22 exhibits a method employed by the Tlingit to cover broad surfaces with porcupine-quills. The quills are laid length-

wise, and side by side on the object to be decorated. Spot-stitches are concealed beneath the ends of the quills, which are turned under. At regular intervals a stitch is made across the surface of the quills. The first is caught into the leather under the quill on the outside edge of the band of decoration, then passed over the next quill and into the leather beneath the third quill, alternating across the entire width of the band. The second row of stitches is commenced by crossing the surface of the first quill, under the

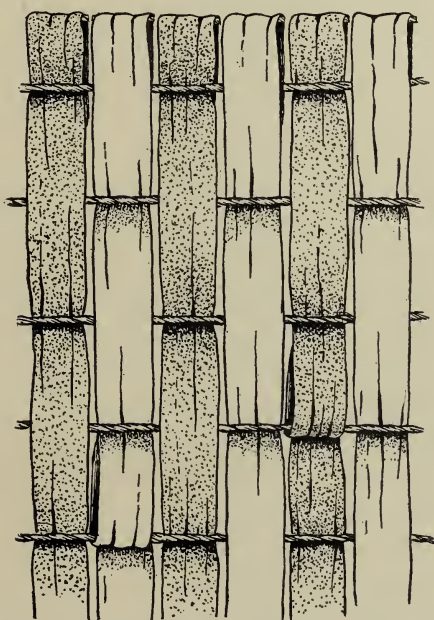


FIG. 22.—A Tlingit method of covering broad surfaces.

second, over the third, and so on. The splicing of additional quills is accomplished by turning the end of the nearly used quill under the nearest cross-stitch, and laying the end of the new quill under that stitch.

A head-band and several similar specimens are in the collections of the Field Museum, Chicago. The drawing (fig. 22) represents the work somewhat spread apart. A pleasing effect is produced by this technique, especially when quills of contrasting colors have been used.

A form of weaving is introduced in figure 23. Attention must here be called to the fact that in the drawing the work is greatly spread apart to show clearly the direction taken by the component elements. The warp-strands are of twisted sinew or some vegetal fiber, the ends of which are knotted into the leather to be decorated. The flattened quills, which form the weft, are passed over and under the warp strands, each row of quills beginning with the same warp element as the row above it; that is to say, the rows do not alternate. If left in this condition the work would fall apart; therefore, to hold the weave together, another strand of sinew or fiber has been woven in between each row of quills, crossing the warp-strands over and under where the quills have crossed under

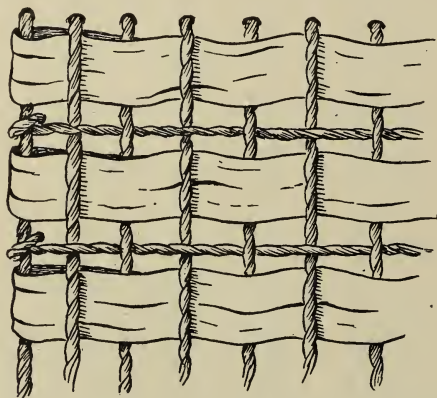


FIG. 23.—Mode of weaving with sinew warp-strands.

and over. The end of this added strand is knotted to the first warp element, and then at regular intervals spot-stitched into the leather. In this technique the elements are all drawn together so that the threads going in the same direction as the quills are seen only under very close examination.

A beautiful specimen of this work (pl. XIII) was collected in Alaska for the United States National Museum. The same technique is to be found on a deerskin garment of Athapascan origin in the Field Museum.

Still another method of covering broad surfaces with quill-work is shown in figure 24. Two strips of rawhide are laid parallel



KNIFE-SHEATH FROM SOUTHERN ALASKA
UNITED STATES NATIONAL MUSEUM



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and wrapped with flattened quills, which are held in position by a twisted sinew thread passing alternately over and under the quills, between the rawhide strips. The quills, having been softened by moisture, are easily crowded together by drawing the thread tight, thus forming a compact wrapping, entirely concealing the rawhide strips. Various widths are found, ranging from about one-quarter to five-eighths of an inch. Such strips are laid side by side and

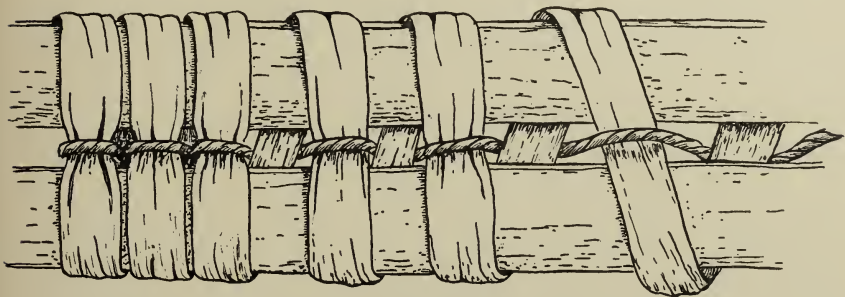


FIG. 24.—Quill-work on rawhide strips for covering broad surfaces.

sewed to the article to be decorated by passing stitches through the loops of the quills on the under side of the strips. The number of strips used and also the length are governed by the size of the area to be decorated. This technique has been made use of by the Tlingit and by some neighboring tribes, but not to a great extent.

Some attempt has been made to introduce designs by changing the color of the quills at measured intervals.

With variation, specimens of this technique have been collected from some of the Pueblo Indians, the difference being in the use of two threads instead of one to bind the quills to the rawhide strips. Figure 25 shows the two threads with a twist between each loop of the quills; in other respects the work is carried out just as it is by the Indians of the northwest coast. Plate XIV, *b*, illustrating an anklet made by the Hopi of Arizona, shows the method of working out designs. The difference in the work of such widely separated peoples can be detected only after very close examination. The usual method of splicing and of supplying additional quills has been observed in this technique.

Plate xv illustrates a highly ornamented circular form of decora-

tion. Such discs of quill-work are found on buffalo-robcs, medicine-bags, etc., and have occurred as tipi ornaments, in which latter case they have been made detachable, not sewed directly to the material of which the tipi-cover was made. The specimen illustrated was to all appearances originally made for a tipi ornament and was subsequently used to decorate a medicine-bag. It may be seen that the quill-work is sewed to an independent piece of deerskin, and then sewed to the bag over some bead-work. Plate xx shows this form of decoration sewed to a quiver. The technique may be called a wrapped coil, but the coils are not sewed together as in the case of coiled basketry. The filler, or foundation, of the coil is composed of horse-hair in modern work, but in one or two

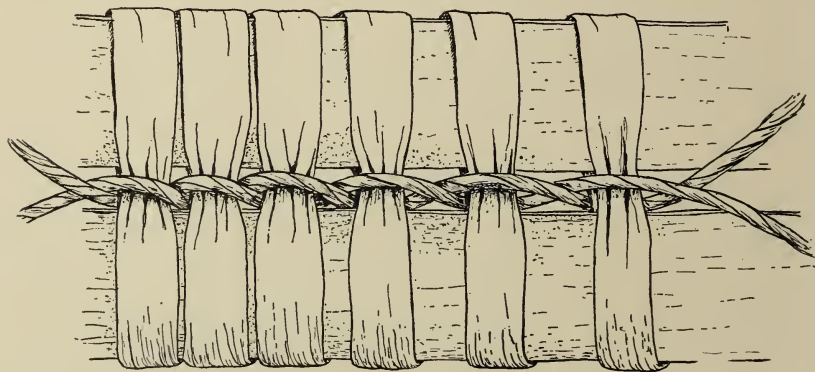


FIG. 25.—The use of two threads for binding the quills.

very old specimens examined the filling has the appearance of human hair, and in others the long hair from a buffalo-tail. A hank of hair of sufficient size to form a coil of the required diameter is wrapped with moistened and flattened quills as shown in figure 26, and through alternate loops of the quills, stitches are carried into the leather forming the base or groundwork of the decoration. It is very evident that the wrapping, coiling, and sewing were manipulated together, especially where a design has been introduced, otherwise the alignment of the pattern would be imperfect.

A buffalo-robe of Blackfoot origin in the Museum of the American Indian has been decorated with four discs of this technique,



DECORATION ON AN OTO MEDICINE-BAG
MUSEUM OF THE AMERICAN INDIAN

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and in addition to various colored quills to produce a design, wrappings of black horse-hair and a fine cord made from vegetal

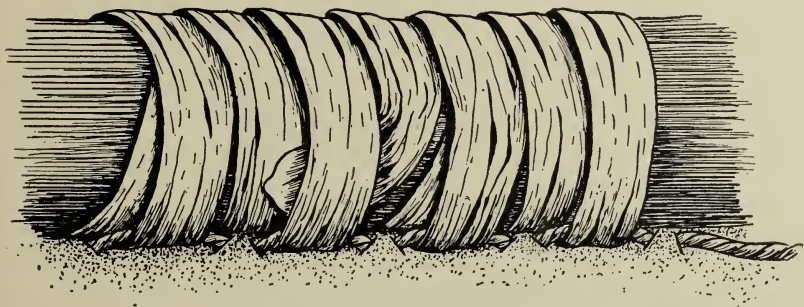


FIG. 26.—Quill-work on a coil of hair.

fiber have been employed, probably to give a touch of variety to the ornamentation. Another form of wrapped filler decoration is shown in figure 27, the general appearance of the ornamentation of which would suggest the same technique as described for figure 26. There is, however, a wide difference in the manipulation of the materials used. Instead of one hank of hair, two are employed. The quills are wrapped around both hanks, and, as the wrapping proceeds, stitches are made over the quills, between the rows and into the object being decorated. The stitches are drawn so tightly that they are entirely concealed. This technique has been used in the form of broad bands, eight or ten or even more being laid lengthwise side by side, serving as shoulder-straps reaching to the waist-line on a deerskin shirt, also as bands on the sides of leggings. So far this technique has not been found in any form other than straight lines. Specimens of this technique have been collected from the Sioux, Nez Percés, and Mandan.

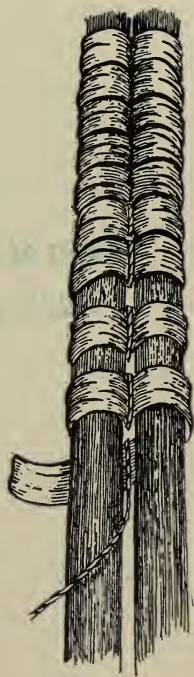


FIG. 27.—Another form of wrapped filler decoration.

Pipe-stems, club-handles, and occasionally horn spoon-handles

have received their share of attention so far as ornamentation is concerned. Various methods have been employed for that purpose. The most simple manner of fastening porcupine-quills to a rounded stick, such as a pipe-stem, was recently brought to light by Dr F. G. Speck while conducting ethnological investigations among the Penobscot Indians of Maine. An old woman of that tribe was induced to make a specimen of quill-work, other than that on birch-bark, which she remembered from childhood. The specimen produced, without any aid in the way of suggestion, was the pipe-stem shown on plate XVI, *d*. The back or under side of the stem is seen in the illustration; the front, of course, presents a series of

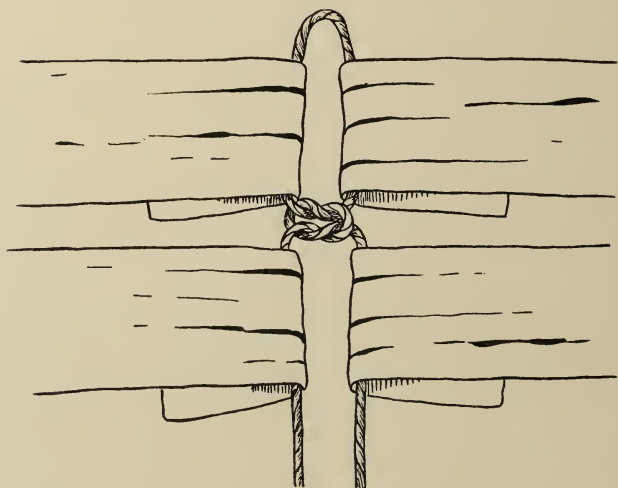


FIG. 28.—Method of fastening quills to a pipe-stem.

unbroken wrappings. The quills are wrapped around the pipe-stem once; the ends are turned under where they meet at the back of the stem and are held by a cord passing through each of those under-turned ends, and the cord is tied between each wrapping. Figure 28 illustrates the method of fastening the quills to the pipe-stem. Pipe-stems with similar wrappings have been collected among the Plains Indians and also from Woodland tribes, but the handling of the fastening cord in most cases has been different.

Figure 29 shows a rather complicated method of tying. The



PIPE-STEMS

a, Sioux; *b*, Kansa; *c*, Sioux; *d*, Penobscot; *e*, Of unknown origin

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drawing perhaps will suffice without further description. In connection with this method a channel was cut lengthwise of the stem into which the cord was sunk, giving to the work a very neat finish.

Plate xvi, *e*, illustrates another wrapped pipe-stem, and figure

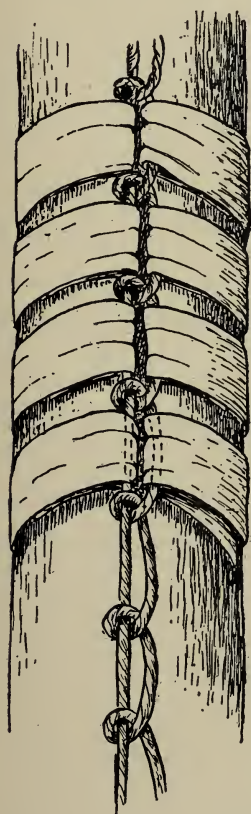


FIG. 29.—Method of tying quills to a pipe-stem.

30 shows the manner of tying. In this case the ends of the quills are not turned under, but are laid over a large cord running lengthwise of the stem; a finer cord is doubled and looped under the large cord; a fine thread is passed under the larger one and is made to cross over the ends of the quills on each side of the large cord. Between the wrappings the fine thread crosses itself under the large cord before passing over the next wrapping. After the last quill is fastened, the loose ends of the fine cord are tied and the

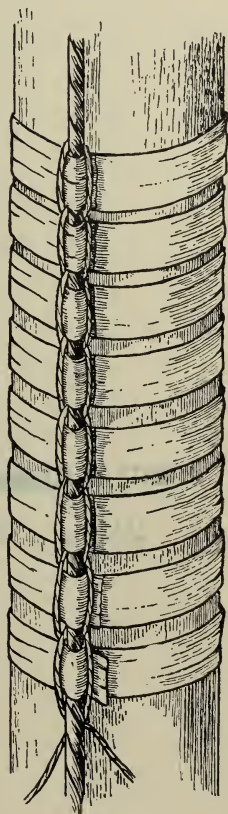


FIG. 30.—Method of tying quills to a pipe-stem.

knot crowded under the last quill, out of sight. The ends of the quills are cut off close to the binding string.

In connection with this form of wrapping, figure 31 indicates still another method of securing the quills. This decoration was found on the legs of an otter-skin which had been made into a medicine-bag collected among the Iowa Indians. At the beginning and finish of the work the cord was knotted and the knots con-

cealed under the quills. A similar decoration, with the same fastening, is found on a cord called a "slave tier," of Winnebago origin,

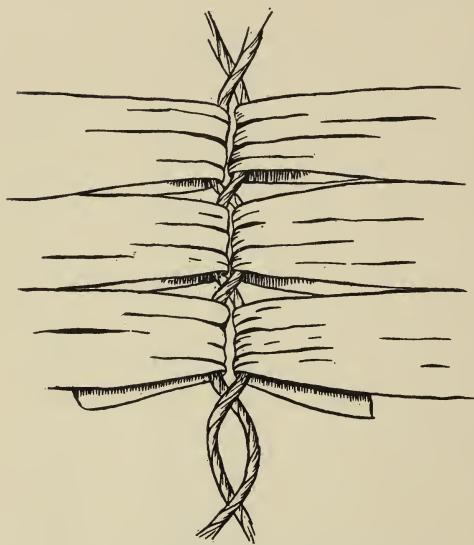


FIG. 31.—Method of securing the quills.

made of twisted buffalo-hair covered with soft-tanned deerskin and wrapped with porcupine-quills.

A very elaborate and complex, and the most common of all forms of decorations for pipe-stems, is shown in plate XVI, *a*, *b*, *c*. Beautiful effects are produced in this technique, and our illustration does not do justice to this particular branch of the art of porcupine-quill work. The

wrapping in this case may properly be called a plaited band, composed of two strings made of twisted sinew over which porcupine-quills are braided in the manner shown in figure 32. The drawing represents the use of one quill in this braid, while reference to

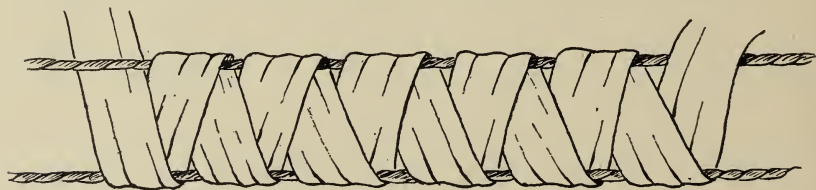


FIG. 32.—A plaited band of wrapping, one quill being used.

figure 33 will show the use of two quills. Both techniques are found on pipe-stems, etc., but that with one quill is by far the commoner.

From personal observation it has been found that the method employed by modern quill-workers (and there is no reason to suppose the earlier artists made use of any other) is to prepare two

long sinew threads without knots, which is done by twisting strands of sinew together just as ordinary string or twine is made. These strings must be of sufficient length to complete the decoration. Knots or an uneven surface are apt to mar the neatness of the work.

The quill-worker, seated on the ground, with legs extended, makes two or three turns of the threads around the pipe-stem, or the first turn is overlapped by the succeeding ones for security. The threads not in immediate use are wrapped around a small stick, which is thrust into the opening of the worker's moccasin or is stuck into the ground directly in front of her, for the purpose of keeping the strings tight as the work progresses. Then with

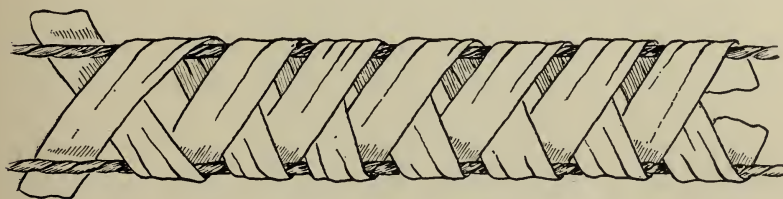


FIG. 33.—A plaited band of wrapping, with two quills.

the pipe-stem, or other object, held at a right angle to the direction in which the strings are stretched, the quills are worked over and under the strings as the drawing indicates. When a sufficient length has been plaited, it is wrapped around the object, at the same time covering the first wrappings of the sinew thread. Two or three turns of the threads on the small stick are taken off and the plaiting proceeds. When a pattern is to be introduced, quills of various colors are inserted at intervals, the distance being determined by laying the braid on the pipe-stem, and the position on the strings noted where the change of color is to take place. The lines of the plaiting may be easily followed in the illustration, which shows the introduction of quills of contrasting colors in their correct positions to produce the design. Some of these braids—the product of early workers—measure only one-sixteenth of an inch in width; modern work is rarely so fine, often measuring an eighth of an inch or more in width.

For a secure finish, the ends of the sinew threads are tucked

under the last few wrappings of the braid. Splicing is performed in the manner elsewhere described. Modern workers make use of commercial thread in place of sinew.

In connection with this technique, mention should be made of a head-band in the Museum of the American Indian, the work of the Karok of California, consisting of a string of plaiting about twelve feet long and three thirty-seconds of an inch wide, simply coiled. The plaiting shows practically the same treatment of the quills as

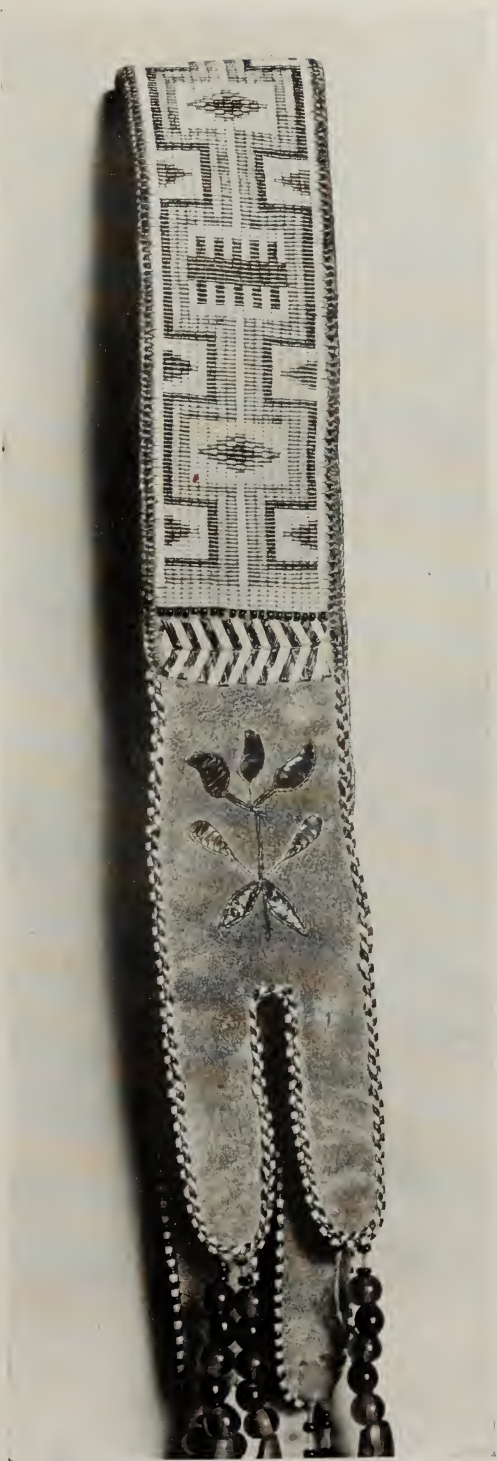


FIG. 34.—Method employed in a long string of plaiting.

is to be found on pipe-stem decorations, except that, where additional quills have been inserted, instead of the usual method of lapping, the end of the added quill has been passed under one of the sinew threads, between the last turn of the used quill (fig. 34); the end of the used quill is in like manner held by the turns of the added quill. As the plaiting proceeded, the quills were brought together tight and close so that the ends could not work loose. The ends were turned in one direction, that is, toward the back of the braid, and were cut off so that they are hardly visible.

In a similar braid, from the Ojibwa of Manitoulin island, the securing of additional quills was accomplished by telescoping (see fig. 7).

Figure 35 represents a purely woven technique in which sewing is not resorted to at all in the work, except when the weave is finished, when it is sewed to a strap of leather for use as an arm-band or a head-dress, or some other object to be decorated. For convenience, in the drawing three warp strands (*a*) are shown lengthwise of the weave, and two rows of quills, which perhaps are sufficient to illustrate the method employed in this interesting technique. Under ordinary circumstances many more warp strands are used in making up such a piece of work. For



QUILL-DECORATED ARM-BAND
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instance, examination of the specimen illustrated on plate XVII discloses the use of twenty such strands, which may be considered rather the minimum than otherwise. This specimen is about one and one-quarter inches wide. Sometimes bands of this work are several inches in width.

The process of weaving consists first of making the warp strands of either sinew or vegetal fiber, which are stretched side by side their entire length on a bow, much as a bow-string would be strung. To keep the warp strands spread apart the desired width, two pieces of thick, leathery birch-bark are perforated with a straight row of small holes corresponding in number with the number of strands to be used, and the distance between the perforations corresponding

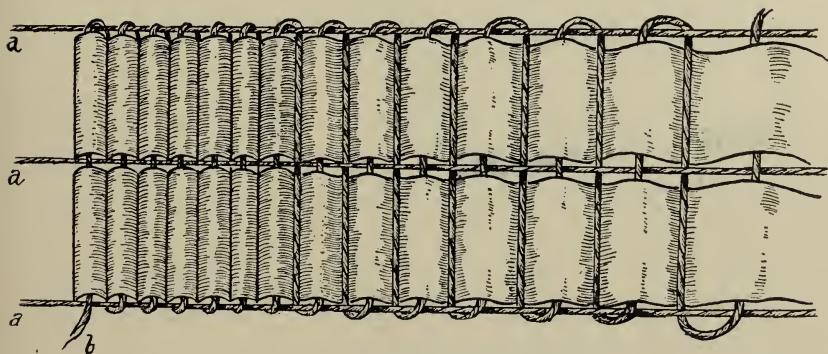


FIG. 35.—Woven technique, without sewing.

with the width of a flattened porcupine-quill. A piece of bark so prepared is placed at each extremity of the warp elements, with a strand running through each perforation. At this stage the loom is set ready for the weaving operation.

Several attempts have been made to secure a loom set up for this technique, but the best result obtainable in this direction is a piece of unfinished work with the birch-bark ends still in position, and a native description of the manner in which the warp strands were stretched on a bow, from which the illustration (fig. 36) was made. In figure 35 the warp strands are marked *a*; another strand, marked *b*, which may be included among the weft elements, is attached to the outside warp strand and then made to pass alter-

nately over and under the warp to the opposite side where it turns and crosses over again, passing under those strands which it crossed over during the previous movement. This operation is repeated to completion. Meanwhile, porcupine-quills have been woven in between the warp strands, over and under the crossing elements.

As the work proceeds the quills are crowded together, so much so that the crossing strands are hidden between the corrugations; in fact, the only strands showing in a finished piece of work are the two on the outer edges, and the loops of the crossing strands, which together form a selvage edge.

As the length of a quill becomes exhausted, the end is allowed to pro-

trude at the back of the work; another quill is inserted with its end in the same position, then the crossing cord *b* is driven tight against the two ends, and the weaving is continued. The quills are used in a moistened, pliable condition; when they become dry, they are stiff and hard, and do not break away from such a fastening. After the work is finished the protruding ends are cut off close to the weave.

In the unfinished specimen of this work, the piece of bark at the lower end of the loom (fig. 36) slides freely up and down the warp strands, suggesting its use as a weavesword to drive the quills up tight and insure a straight line across the weave. From the accuracy with which the quills are lined across the weave it is evident some implement must have been used to bring about the exquisite

FIG. 36.—Quill-work in process—the warp strands stretched on a bow used as a loom.

finish so noticeable in this work. From a mechanical point of view the piece of bark referred to is an ingenious adaptation if we assume that it was used both as a spreader for the warp strands and as a weave-sword.

This form of decoration has the appearance of being composed of fine, cylindrical beads. Specimens have been collected from the northern Athapascan tribes, the Indians of the Great Lakes, and the Iroquois. Owing to the technique, the designs are angular. However, some very striking patterns have been produced, especially worthy of notice being that illustrated in the frontispiece, in which the harmonious blending of colors is typical of porcupine-quill work generally.

The greater part of the detail of the art of porcupine-quill work thus far described is of such a nature that the designs are inclined to angular patterns, due no doubt to the methods employed and in some measure to the fact that many of the specimens examined were collected from Indians of the Plains, whose art seems to have been more or less influenced by their environment—with the ever-present cone-shaped tipi, perhaps the distant mountain peaks, the trails, and other objects suggesting straight lines, all of which were more or less conventionalized in their designs.

Geometrical designs, however, are not uncommon in the work of the Woodland Indians; but the art of these people to some extent indicates a tendency toward designs suggesting plant life, the absence of which is noticeable in the art of the Plains tribes. Thus may the question of environment be considered also in the art of the Woodland people.

Tendrils, stems, branches, leaves, and flowers are represented sometimes in realistic fashion. The graceful curves of nature are reproduced with remarkable skill in most exquisite line-work, involving many intricate foldings of the quills and seemingly impossible stitches, especially when we consider the fact that the most primitive tools were used—an awl, perhaps made of bone or simply a thorn, and for a needle the stiffened end of a sinew thread.

A number of methods of folding the quills have been employed by the Woodland Indians in representing plant life that were not

used by the people of the Plains, whose style of art consisted mainly of covering extensive surfaces, that is, patterns with a solid background of quills.

Plate XVIII illustrates an entirely different style. An exquisite floral design has been worked, leaving the leather to form a background. Conventionality has not been carried so far as to obscure



FIG. 37.—Use of two quills of contrasting colors on a lace of deerskin.

the artist's intention of faithfully representing leaves and flowers with their stems and gracefully curving tendrils. The specimen referred to is one of many collected years ago, but either the record of it has been lost or none was made, so that its origin is not certainly known; but after comparison with readily identifiable modern work, there is every reason to believe that this choice piece of porcupine-quill embroidery is of Iroquois origin. There are

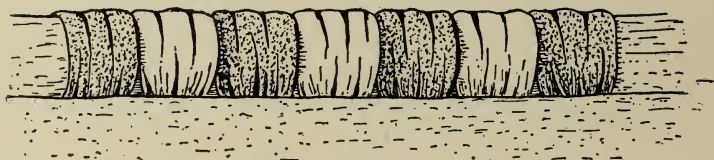


FIG. 38.—Reverse of the edging shown in figure 37.

several techniques in this specimen which are not found in the work produced by the Indians of the Plains. The edges of the pouch and shoulder-straps (the straps are not shown in the illustration) are embellished with a very ornamental technique consisting of a series of quills wrapped over a filler and sewed to the edges. Figure 37 illustrates the use of two quills, one overlapping



QUILLED POUCH, PROBABLY IROQUOIS
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the other, of contrasting colors, which have been turned over a lace of soft deerskin forming a filler. Stitches have been made over each quill, as may be seen in the drawing. Figure 38 illustrates the reverse view of this edging, which at first glance has very much the appearance of beadwork along the edges of the object.

In figure 39, instead of two quills, one has been used. The drawing shows the method of folding and the direction of the stitches,

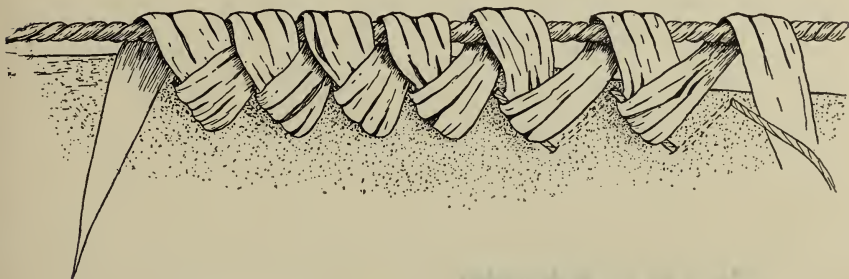


FIG. 39.—Method of folding a single quill on a cord of sinew or vegetal fiber.

also that a cord of sinew or perhaps of vegetal fiber has been used instead of a deerskin lace.

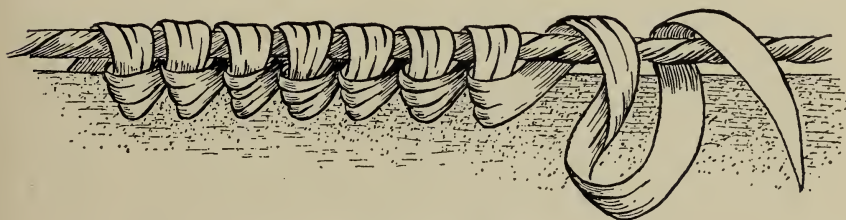


FIG. 40.—Another method of folding the quill for edging.

Figure 40 illustrates an entirely different fold of the quill, but the stitches are carried over the lower turns of the quills as shown in figure 39.

Figure 41 represents a single-quill edge with a fold similar to that shown in figure 37, but the treatment of the stitches is different, each stitch being made to cross the quill in two places instead of one, thus changing the appearance of the edging.

There is a possibility that the two methods last mentioned express the individuality of the makers, as they occur but once in

all the specimens examined. Unfortunately the provenience of the specimens is unknown, but the general character of the design suggests the art of eastern Indians, probably the Iroquois.

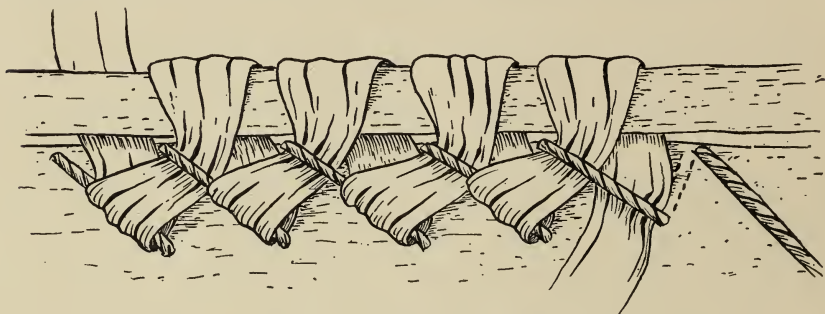


FIG. 41.—A single-quill edge with change in treatment of the stitching.

Another variation of a single-quill edging in conjunction with a cord filler is shown in figure 42. The simple foldings and stitches are clearly shown in the drawing, therefore further description is unnecessary. This edging appears on a specimen collected from the Iowa tribe. It is a very old piece, and as the edging is the only one showing this particular folding, the treatment may be placed in the individual class. This statement as to individuality must

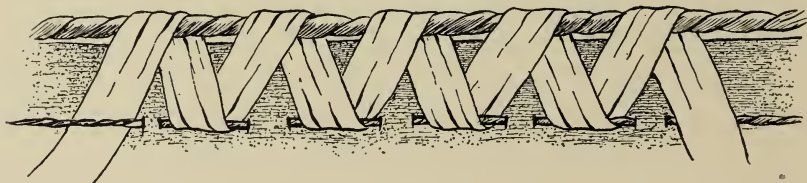


FIG. 42.—Variation in single-quill edging with a cord filler.

not be accepted as positive, as no doubt there are many specimens of quill-work that as yet are not accessible for examination.

An attractive edging is represented in figure 43. The quills have been folded in such manner as to form a sawtooth pattern, with the points of the teeth turned away from the edge. Stitches have been passed through the loops of the turnings, into the surface of the leather and out at the extreme edge. The edgings described are all made up of very fine quills and small stitches, and the work

is drawn so close together that the stitches are hidden, except in that edge shown in figure 41; but the sewing is so fine and tightly drawn in this case that it is barely visible. These fine edgings are not found on modern work, for although some attempts to approach it have been made, the results are coarse and ragged, and do not possess that fine finish so characteristic of the old work.

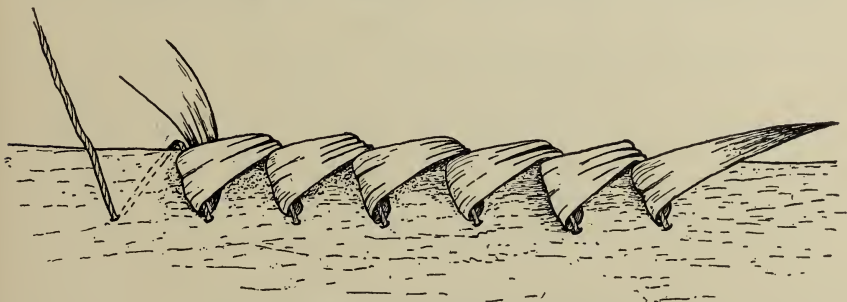


FIG. 43.—Quill edging of sawtooth pattern.

Another method of decorating an edge is shown in figure 44. Here the quills have been folded over the edge of the leather from front to back, both sides having the same appearance. Spot-stitches have been carried entirely through, catching first one side, then the other. This technique has not only been applied to deer-

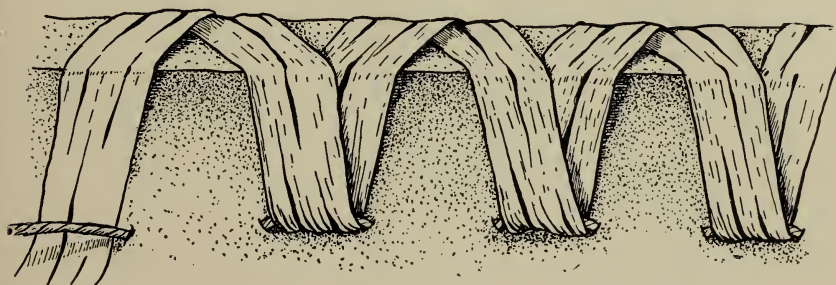


FIG. 44.—Edging produced by folding the quills from front to back.

skin, but frequently appears on intestine containers for quills, an illustration of which may be seen on plate IV. This specimen has been decorated at both ends.

An examination of the detail of the work illustrated on plate XVIII will show that the leaves and flowers have been outlined with

a fine, hair-like line. Figure 45 depicts the method employed. The quill is flattened and twisted in such manner that a stitch is made between each turn of the quill; the thread is caught into the leather under the upper, and passes over the lower turn, entirely



FIG. 45.—Detail of the method of outlining shown on Plate XVIII.

concealing the sewing. A line so made can either be turned in an unbroken curve or made straight to conform to the artist's desire. Such lines occur so small and fine that it is almost incredible they could have been made without the use of a fine needle and thread.



FIG. 46.—A simple form of line-work.

A simple but crude form of line-work is shown in figure 46. In this case the quill has been simply laid on the article to be decorated and sewed over and over.



FIG. 47.—A form of folding with diagonal stitching.

Figure 47 represents the same folding as is seen in figure 45, but with diagonal stitching instead of a series of stitches made in the same direction as the line.

Figure 48 illustrates a method of making a raised line. The quills have been wrapped around a sinew cord, or perhaps a split bird-quill, and sewed to the decoration by passing the stitches through the loops formed by the quills as they were wrapped around

the filler. A variation of this is shown in figure 49. in which, in addition to the bird-quill filler, a string or small cord is included

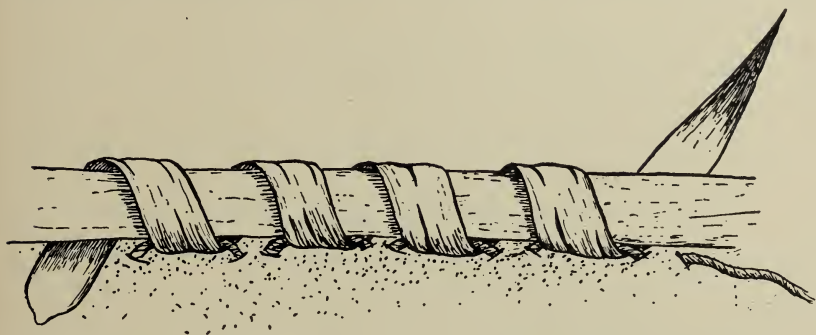


FIG. 48.—Method of making a raised line by wrapping around a core of sinew or of split bird-quill.

and the stitches are made over that, instead of through the loops of the quills.

These raised lines are rather striking in effect and are found frequently around the outer edge of a panel of some floral design, but not as a fine line around the edges of leaves, etc. Because these lines have a filler, it must not be thought that they are at all

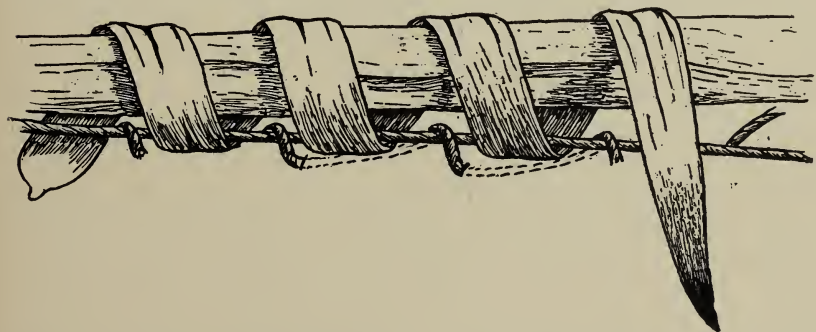


FIG. 49.—Method of making a raised line with a string in addition to the usual filler.

coarse, as some have been measured that are only a sixteenth of an inch in diameter.

Another raised-line effect appears on a game-bag decorated by the Loucheux. The folding of the quills is similar to that shown in

figure 21 and also like the pipe-stem braid in figure 32. In the Loucheux work a cord has been laid under the quills between the stitches (fig. 50), producing a very neat, rounded appearance to the line. This specimen of line-work is one-eighth of an inch wide.

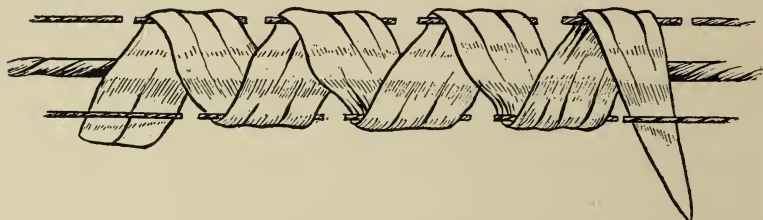


FIG. 50.—Raised-line work, a cord being laid under the quills.

The beautifully curved tendrils illustrated on plate XVIII are made with a complex folding of the quills, producing what may be called a double serrate line. Figure 51 illustrates the direction of the folds of the quills, and also the position of the stitches. The

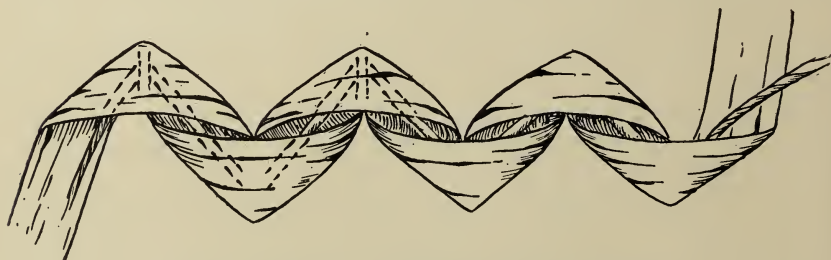


FIG. 51.—Detail of the folding shown in Plate XVIII.

dotted lines indicate the stitches following the shape of the teeth and the points at which they enter the leather under the apex of each turn.

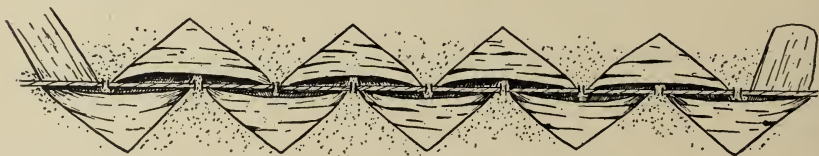
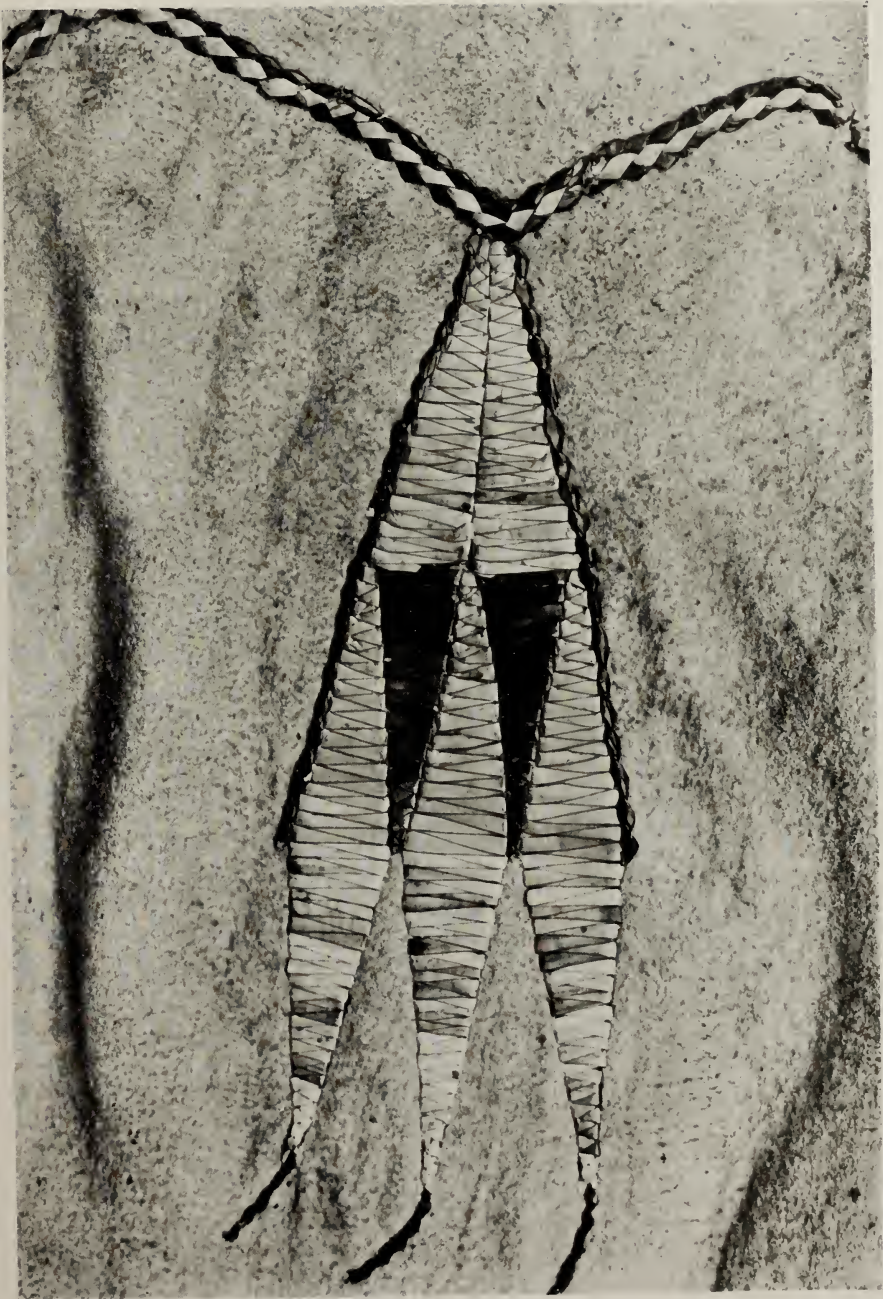


FIG. 52.—A variation of the folding shown in Figure 51.

A variation is shown in figure 52, in which case the sewing is carried straight along the line, although the folding is the same as



DECORATION ON A GROS VENTRE PIPE-BAG
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in the last example. It will be observed that the thread is caught into the leather between the points. In both instances, however, the work is done so neatly and is drawn so tightly that the sewing is entirely concealed. This technique has been observed in many specimens of the older work. Several pieces of modern work presenting the same technique have come to notice, but the fine finish of the early artists is lacking.

An interesting bit of line-work was found on a pipe-bag collected from the Cheyenne; it has the appearance of a very fine, single-link chain, and is made of quills with points and ends cut off and laid in loops crossing at regular intervals, and stitched over the crossings (fig. 53). Little or no attempt has been made to conceal the cut ends of the quills; nevertheless the work is so fine that this defect is hardly noticeable. The sewing is not hidden, but its exposure rather adds to the decorative effect than otherwise. The links are about one-eighth of an inch wide. This is the only piece of this technique that has come to notice, and it may be another expression of individuality.

A very neat line has been embroidered on several specimens in the Catlin collection, of unknown tribal origin, and reappears on a modern piece of work by the Gros Ventres (pl. XIX). The line crossing the upper end of the plate is the one referred to. The illustration shows three rows of quills. The technique of the top row has been described, and is illustrated in figure 45. The two lower rows are of an entirely different technique. In making this line two quills of contrasting colors have been used, and so folded as to form a pattern consisting of a series of interlocking diamonds (fig. 54). The dotted lines in the drawing indicate the method of



FIG. 53.—Line-work on a Cheyenne pipe-bag.

folding and the overlapping of the quills one over the other. A spot-stitch has been used, crossing the underlying folds, and the stitches are all concealed.

The specimen of Gros Ventre work shown in the plate does not present the fine, careful finish so apparent in the Catlin specimens.

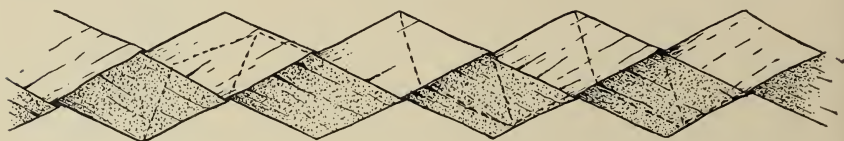


FIG. 54.—Method of folding two quills of contrasting colors to produce series of interlocking diamonds. (See pl. XIX.)

Unfortunately the latter are in such a poor state of preservation that they are not suitable for illustration.

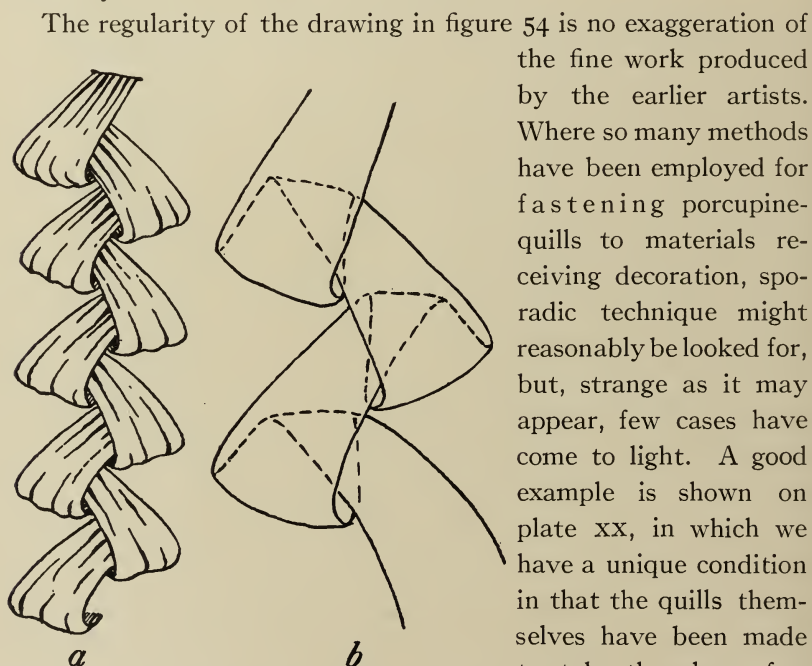


FIG. 55.—Detail of method of threading the quills through skin. (See pl. XX.)

the surface of the deerskin in the form of what is commonly known as a herring-bone stitch.



QUIVER OF NORTHERN PLAINS ORIGIN

UNITED STATES NATIONAL MUSEUM

The drawing (fig. 55) presents the method of threading the quills through the skin. Nothing like this has been found in the many specimens examined. In the first place, no thread has been used to fasten the quills, and the herring-bone pattern has not been used on any other specimen, so far as known. The piece of work referred to may be seen on the plate in the form of three diamond-shaped figures between the discs.

The fact that examples of individuality are so few (the workers being apparently satisfied with the methods commonly in vogue), and the wide distribution of many techniques, would suggest that the art of porcupine-quill work was practised many years before the arrival of Europeans on the American continent. A great length of time would be necessary for knowledge of the various methods to become so widespread.

Figure 56 is an enlarged drawing of a very delicate rosette which occurs on several unidentified specimens. In plate XVIII examples of this embroidery are shown with a fine, hair-like line worked around the edge of the rosette, the technique of which is shown in figure 45. Considering the size of the rosette in question, a trifle more than a quarter of an inch in diameter, this is a remarkable piece of work. The method of folding the quills to produce the circle is shown in the drawing (fig. 56); the outer edge is secured by the simple spot-stitch between each fold, while the center is held by a draw-string running through the loops of the quills and fastened into the leather with one stitch. Some of these rosettes show the use of two or more colors.

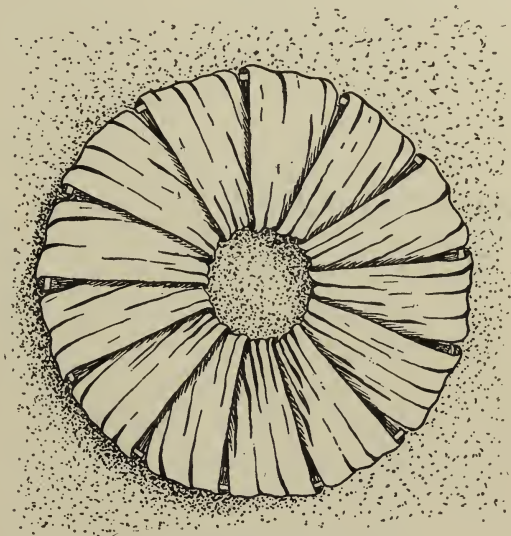


FIG. 56.—Rosette in quill-work.

Fringe forms a common feature of the decorative scheme of the North American Indians, and is made usually of strips of deer-skin ranging from an inch or two to eighteen or twenty inches long and from an eighth to a quarter of an inch wide, and is applied to clothing in various ways, as well as to other articles for which such

decoration is suit-

able. In many cases ornamentation has been applied to the strands of the fringe, such as wrapping them with porcupine-quills. Sewing has not been resorted to as a means of holding the quills in position where soft-tanned deerskin has been used for the fringe strands, but where raw-hide or other stiff leather has been employed, a thread has sometimes been used, under which the ends of the quills have been tucked,

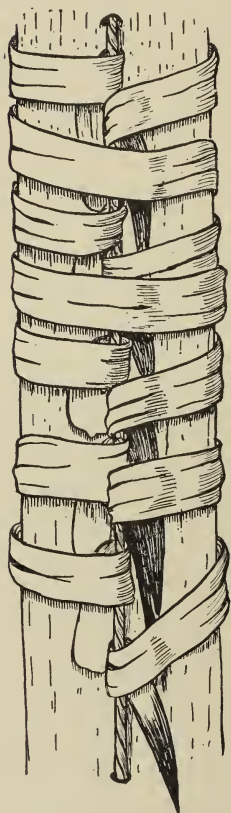


FIG. 57.—Method of ornamenting fringe with quill-work.



FIG. 58.—Method of ornamenting fringe with quill-work.

but not in the sense of sewing as applied to other techniques.

Figure 6 illustrates the method of fastening quills to a fringe of soft-tanned leather. The wrappings are laid over the ends, and where additional quills have been applied or spliced on, the two



POUCH FROM SAUK MEDICINE-BUNDLE
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ends are held together with a half-turn or twist and the wrappings carried over these twisted ends. This makes a continuous and secure binding that does not readily become displaced. The turns of the quills around the fringe strands are made close together, so that the splicing and the ends are concealed. Long strings for pendent objects and tie-strings for moccasins have been decorated in this fashion.

This method has been used to some extent where the fringe strips have been made from rawhide, such as is frequently found on pipe-bags. There seems, however, to have been a preference for the use of a fine cord fastened at each end of the fringe strip when made of rawhide. The ends of the quills were given a half-turn around the thread, and the wrappings passed over the ends as shown in figure 57. In this case the quills were wrapped so closely that the ends and the cord were concealed. A similar wrapping is shown in figure 58, with a variation, two quills being worked along together instead of a single quill.

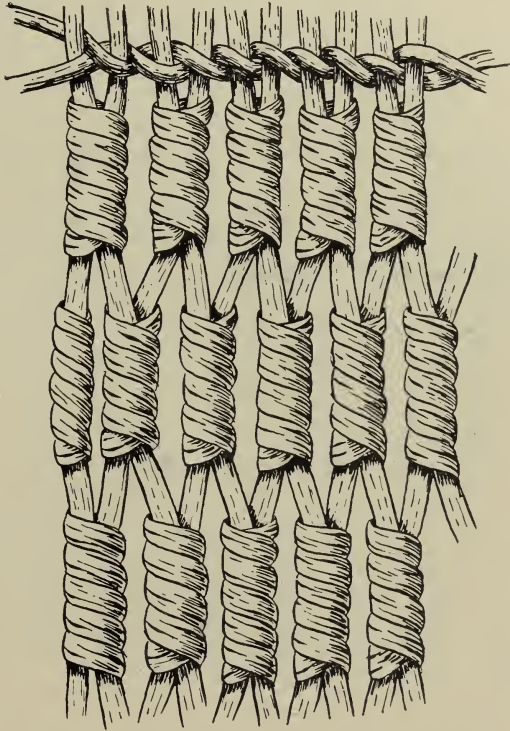


FIG. 59.—Method of ornamenting fringe with quill-work.

Wrapped fringes were apparently very popular among the quill-workers of the past, and the liking for that form of decoration prevails among modern workers, although the work is not so care-

fully done. Judging by the specimens collected from the Plains tribes, they evidently had a preference for rawhide strips for fringes, except on clothing. Moccasins, however, are occasionally found with such fringe.

In many cases where stiff leather has been used for fringe, the strips have been fastened in such manner that they could not

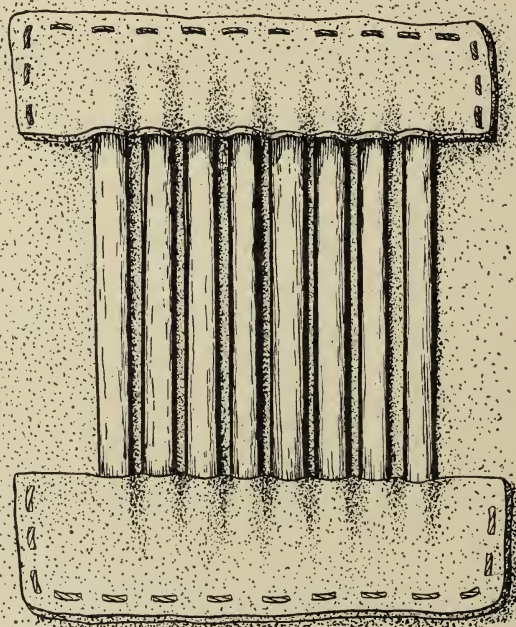


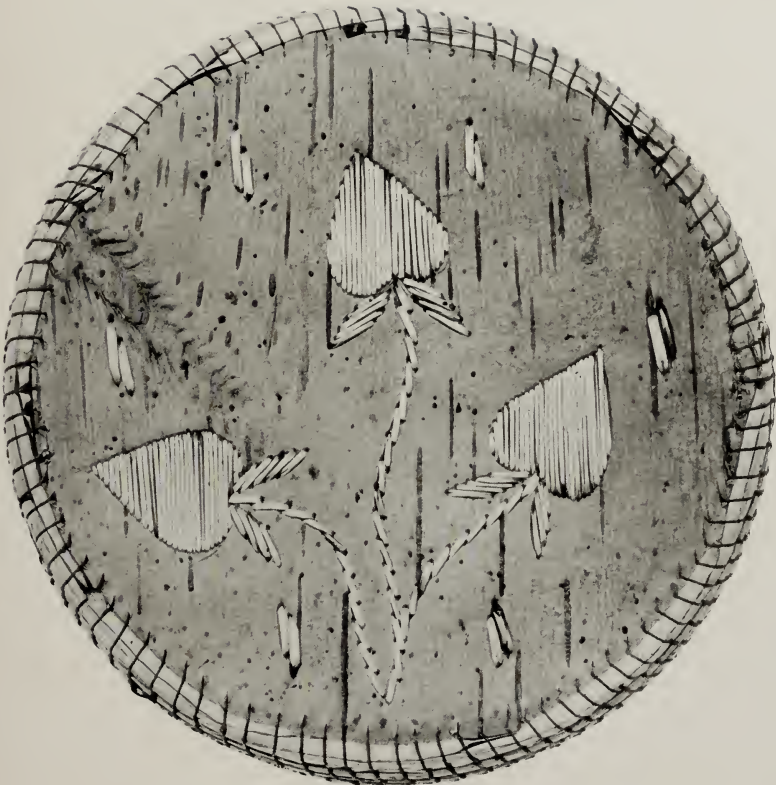
FIG. 60.—Example of crude quill-work by Thompson River Indians.

spread apart, and by the introduction of quills of various colors in measured spaces, some elaborate patterns have been worked out.

Plate xxi illustrates an interesting form of netted fringe made of a series of strands bound together in pairs. In figure 59 it will be seen that the first row of wrappings has taken the first and second strands, then the

third and fourth, and so on across the width of the fringe. On the second row, the first strand alone has been wrapped, then the second and third, thus alternating the pairs with the row above, producing the net-like arrangement of the strands, with the quill-wrappings taking the place of knots of an ordinary net.

The drawing exaggerates the spread of the quills somewhat;



COVER OF CIRCULAR BOX. MODERN CHIPPEWA COMMERCIAL WORK

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the example illustrated has the strands almost concealed, although another object collected from the same source had the strands only partly covered. The specimens referred to were parts of the contents of two very old medicine-bundles collected from the Sauk and Foxes. Some attempt to introduce design was made by a change of colored quills producing straight lines across the fringe, which show indistinctly in the illustration. To secure the wrappings, the ends of the quills were tucked under the first and last turns, as is clearly shown in the drawing.

A rather crude piece of quill decoration emanated from the Thompson River Indians of British Columbia. The decorated objects consist of some horse trappings. The porcupine-quills have been cut into short lengths and are held in position by pieces of deerskin sewed over both ends of the quills which are laid side by side as shown in figure 60. This example is recent work and is said to be a survival of an old form of decoration.

A young Paiute man, a student at the Carlisle School, was questioned as to his knowledge of porcupine-quill work among his people. His request for materials being complied with, he fashioned an ornament as illustrated in figure 61. This is made of sections of quills cut in equal lengths and threaded as one would string beads, with a piece of leather between the sections of quills. According to his statement, it is an old form of decoration among his people, was sometimes made several feet in length, and was used as part of a woman's headdress.

DECORATION OF BIRCH-BARK

The process of fastening porcupine-quills to birch-bark for decorative purposes is found to be very simple when compared with similar work on leather. Sewing is entirely dispensed with.

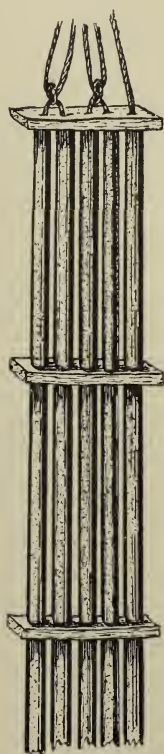


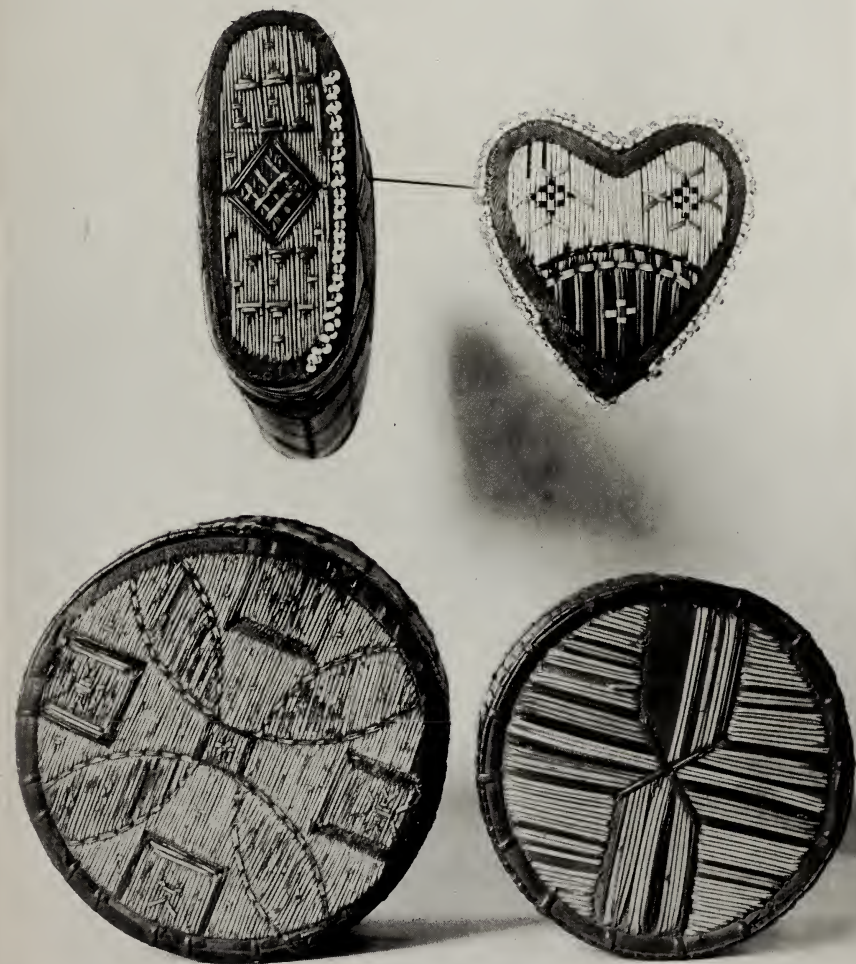
FIG. 61.—
Threaded quill-
work made by a
young Paiute.

Perforations are made in the bark with an awl somewhat smaller in diameter than the quills, following a design which has been drawn with a blunt-pointed implement usually made of bone or antler. A lead pencil is frequently used for tracing designs on modern commercial articles. The perforation is made immediately before the end of the quill is inserted, when the bark contracts to some extent and holds the quill tight. Unflattened quills are invariably used in this form of decoration.

Plate xxii illustrates the cover of a birch-bark box, such as is frequently found for sale at summer resorts and in curiosity shops. The design is simple, and easily and quickly applied—an important feature duly considered by the Indians when an article is made for sale. The edge has been trimmed with sweet-grass sewed with commercial thread. However, the specimen well serves the purpose of illustrating quill-decoration on birch-bark in its simplest form. The design has been worked out very tastefully, and there is a certain charm in its simplicity.

The methods employed in this case are the same as have been used on all quilled birch-bark. The design is outlined with a blunt-pointed instrument. Sometimes a stencil or cut pattern is used to guide the marker: this fact speaks for itself in the illustration, which shows three leaves to be of exactly the same shape and size. Light pressure with the bone marker produces a well-defined line on the bark which is not easily obliterated. Some specimens have been examined which show that the design had evidently been drawn without the aid of a pattern. In these instances, however, duplication of design does not occur to any extent. When the drawing is completed, the artist proceeds to fit the quills to the pattern.

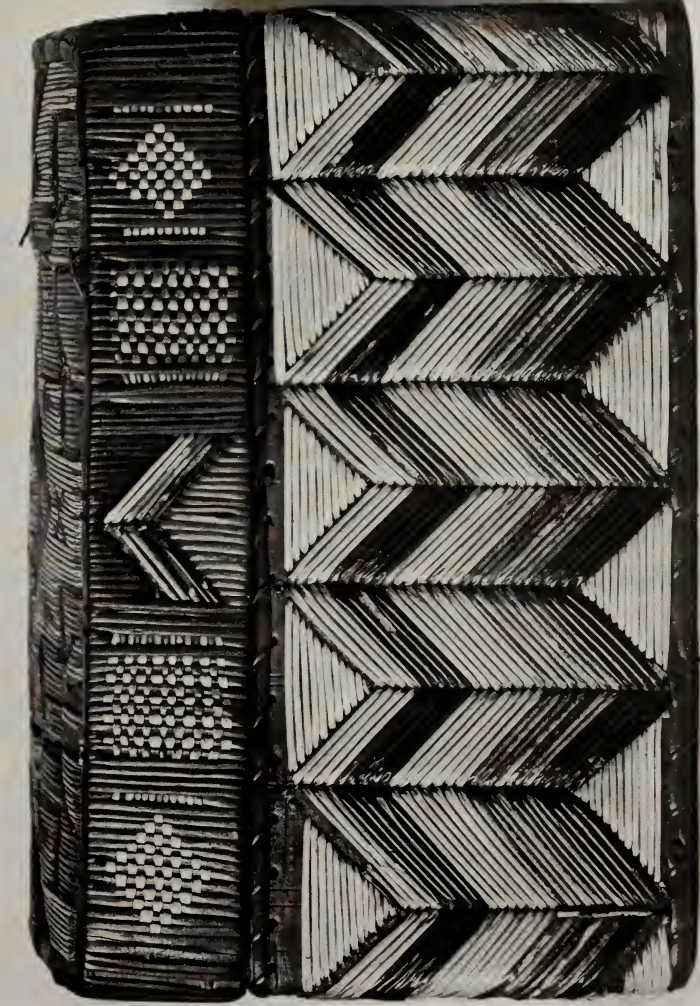
The treatment of the stems of the leaves in our illustration resembles what is known as the "outline stitch" in modern embroidery, but with the difference that the quills do not form a continuous thread as in the case of an embroidery stitch, but are cut off close to the bark on the under side; that is to say, each stitch is simply a short piece of quill with its ends turned down into the bark. This is effected by passing the quill point first through a



QUILLED BIRCHBARK BOXES. MICMAC
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QUILLED BIRCH-BARK BOXES. MICMAC
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QUILLED BIRCHBARK BOXES. MICMAC
MUSEUM OF THE AMERICAN INDIAN

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perforation, from the under side, then from the upper side to the back, and cut off. Sometimes a quill is long enough to make several such stitches.

The leaves are given similar treatment: perforations are made along the outline, quills are inserted across the leaf, and cut off in the same manner as for the stems. This bears a resemblance to the "satin stitch" in our embroidery. Many specimens showing realism in design have been collected from the Indians inhabiting the Great Lakes region, while those to the eastward have produced more designs of a geometric nature. New Brunswick and Nova Scotia seem to lead in the latter form of decoration. Plates XXIII-XXV present some elaborate geometric designs. An artistic selection of colors has added greatly to the exquisite workmanship of the quill-work on the specimens illustrated.

The rectangular box represented in plate XXV shows a variation in decoration around the sides of the cover. Excepting a small square shown in the center of the picture, the sides have been wrapped with split spruce-root and decorated with interwoven quills in rhomboids and squares. This form of ornamentation occurs frequently and is often found to cover the sides of the boxes as well as the sides of the covers, but no box has been found with the top so decorated.

In nearly every case in which a birch-bark box is decorated with porcupine-quills, a thin piece of bark has been secured to the reverse side of the decoration, possibly as a protection for the cut ends of the quills, and in any event adding a very neat finish to the inside of the box.



EASTERN PORCUPINE (ERETHIZON DORSATUS)

BY PERMISSION OF THE NEW YORK ZOOLOGICAL SOCIETY

M 97c

CONTRIBUTIONS FROM THE
MUSEUM OF THE AMERICAN INDIAN
HEYE FOUNDATION
Volume IV, Number 2

CERTAIN ARCHAEOLOGICAL INVESTIGATIONS IN TRINIDAD,
BRITISH WEST INDIES

BY
THEODOOR DE BOOY

Reprinted from the AMERICAN ANTHROPOLOGIST (N.S.), Vol. 19, No. 4,
October-December, 1917

NEW YORK
MUSEUM OF THE AMERICAN INDIAN
HEYE FOUNDATION

1918



CERTAIN ARCHAEOLOGICAL INVESTIGATIONS IN TRINIDAD, BRITISH WEST INDIES¹

BY THEODOOR DE BOOY

INTRODUCTION

AS this paper is intended solely to put on record the excavations made by the writer and some of the resulting specimens, it does not seem advisable to go extensively into the previous literature existing on the archaeology of Trinidad. Neither does the writer consider it imperative to illustrate many of the artifacts found or to discuss them at length, he being more desirous of explaining the conditions under which the objects were found. Some three thousand specimens in all were sent to the Museum of the American Indian from Trinidad during the four months that the writer worked on this island and it would require a bulky monograph to thoroughly describe each separate specimen.

Dr. J. Walter Fewkes, of the United States Bureau of American Ethnology, made a survey of some of the shell-heaps at Erin Bay on the south coast of Trinidad for the Museum of the American Indian (Heye Foundation) (which at that time was known as the Heye Museum),² and the Reverend Thomas Huckerby, who was then

¹ After an archaeological exploration of the island of Margarita off the north coast of Venezuela from February to May, 1915, described by the writer in a previous paper, (Booy, Theodoor de, "Certain Archeological Notes on the Island of Margarita (Venezuela)," *Contributions from the Museum of the American Indian (Heye Foundation)*, Vol. II, Number 5), a certain amount of work was done in the British island of Trinidad, 120 miles to the eastward of Margarita and the writer remained here from May until September of the same year. The local government of this latter island and a number of the residents and landowners were of great assistance to the writer in his archaeological work and he wishes to take this opportunity to tender the thanks of both the Museum of the American Indian (Heye Foundation) and of himself to Paul Urich, Esq., of the St. Bernard Estate near Cape Mayaro, on whose property the greater part of the work was done, to Mrs. Paul Urich for her unfailing kindness and hospitality, to Carl Boos, Esq., of Port-of-Spain, for his aid in innumerable matters and to the officials of the Royal Victoria Institute of Port-of-Spain.

² Fewkes, J. Walter, "Prehistoric Objects from a Shell-heap at Erin Bay, Trinidad," *American Anthropologist* (N. S.), vol. 16 (April-June, 1914), pages 200-220.

living in Trinidad, conducted some excavations on the St. Bernard estate near Cape Mayaro, the results of which excavations are now in the Museum of the American Indian (Heye Foundation) as are the specimens obtained by Dr. Fewkes at Erin Bay. The Huckerby specimens proved to be somewhat different from those collected by

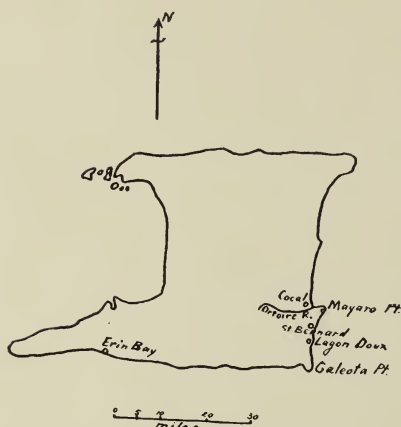


FIG. 61.—Map of Trinidad.

Dr. Fewkes and as Mr. Huckerby obtained only comparatively few objects, the writer decided to make a thorough investigation of the remains on the east coast of Trinidad, to see if a different culture could have existed there. On arrival at Port-of-Spain, therefore, he was introduced to Mr. Paul Urich, who owns extensive plantations on the east coast of the island near Cape Mayaro (see map, fig. 61) and received a cordial invitation to come there

and to excavate on the St. Bernard property. It was on this same property that Mr. Huckerby had made a number of somewhat superficial investigations and had collected those specimens that had first drawn the writer's attention to a difference between the east coast and the south coast pottery.

The shell-deposits in which the pottery and other pre-Columbian objects were found are situated on the St. Bernard property, about one and one half miles south of Cape Mayaro and one fourth of a mile inland from the sea beach. It is likely that in pre-Columbian times these deposits were a far greater distance from the sea, possibly from three fourths of a mile to a mile. The tides on this part of the east coast of Trinidad are so strong that the seashore is constantly being pushed further inland; on riding along the shore, one sees stumps of cocoanut trees on the beach as mute evidence of groves that existed before the sea swept them away and a number of the palms overhang the beach itself with part of the roots exposed by the action of the waves. After each severe easterly storm, a

*a**b**c**d**e**f*

EXCAVATIONS IN PROCESS IN ST. BERNARD MIDDENS, TRINIDAD

a. Clearing ground for trench. *b.* Diluvial deposit covering shell-heaps. *c.* Trench, 10 feet wide, through hummock. *d.* Shell- and ash-layer in deposit. *e.* Ash-layer in deposit underneath layer of *tivela mactroides*. *f.* Sherd *in situ* in shell-layer.

number of the trees fall, owing to the fact that the waves have washed away the soil and sand that supported the roots. The writer has been assured by competent geologists that probably not more than five hundred years ago, the shore ran in a straight line from Mayaro Point to Galeota Point, which would place the St. Bernard middens fully a mile inland.

The St. Bernard deposits cover an area of possibly from six to eight acres of land and lie in what now is a cocoanut grove and what some sixty years ago was a field of sugarcane. Since the abandonment of the village site by the aboriginal inhabitants and the subsequent sugarcane and cocoanut cultivation, the shell-heaps have become covered with a diluvial deposit from one to two feet deep, so that the individual middens can hardly be recognized amid the light undergrowth that covers the soil. The writer was not able to determine the number of the individual hummocks for this reason and had to make his excavations in those places where test holes proved the deposits to be the thickest.

The first process in the excavations was to clear the slope of a hummock of the small brush and to run the lines of a future trench in such a manner that they avoided the cocoanut trees as much as possible. A clearance three feet in diameter had to be given to each tree in order to avoid damaging the roots too much. The accompanying illustration, plate III, *a* gives one an idea of the largest hummock found on the St. Bernard estate which hummock was about ten feet high. The roots of the cocoanut trees interfered to a great extent with the excavations and are no doubt responsible for a considerable amount of breakage of the pottery objects found; also, the writer had to watch the laborers constantly to prevent their chopping off the roots too near to the trees, in which event a number of the palms would have been damaged beyond recovery. It generally was possible to make the trenches from ten to twelve feet wide and to excavate in such a manner that the shells and the soil filled the trench up again back of the laborers, leaving eight feet of the bottom of the trench cleared between the cut and the refilled trench. An excavation of this sort can be seen in plate III, *c*.

The deposits themselves ranged in depth from seven feet to less than a foot and, as has been stated, were covered with from one to two feet of diluvial deposit. Practically no objects were found in the diluvial covering, with the exception of small sherds and shells that had been moved towards the surface at those times when the soil was disturbed in cultivation. This diluvial deposit can be clearly seen in plate III, *b* and the first shell-layer under the diluvium is indicated by the laborer with his cutlass. Under the diluvial deposit came a series of clearly defined shell- and ash-layers showing the various periods of occupation of the village site. These layers reached a large number where the deposits were seven feet thick and, as is shown in plate III, *d*, did not run parallel to the surface of the ground nor did they run parallel the one to the other. It would seem as if the aborigines built their refuse-heaps in a different spot on each successive occupation, although on the same village site, which practice would account for the various angles at which the layers ran. The artifacts were most generally found in the darker ash-layers shown in the illustration. Fairly large fragments of charcoal were met with in the ash-layers and also pieces of pitch or manjak. These latter pieces probably came from the deposits that are found in various places on the east coast of Trinidad. It may be mentioned that the writer excavated a number of pottery fragments that showed signs of having been covered with this pitch; whether these fragments are of vessels in which the pitch was melted or whether the pitch had been put in the vessels to mend them, the writer is not prepared to state definitely, although in one or two instances he is almost positive that vessels had been so restored.

The shells in the shell-layers of the deposits were not mixed with soil and were comparatively clean. The ash-layers, on the other hand, were a sticky gray mass in which bone fragments, shells, charcoal and ashes were mixed. A typical ash-layer is shown in plate III, *e* and underneath this layer can be seen a shell-layer composed of the shells of *Tivela mactroides*. The writer estimated that some 40 per cent. of the shells found in the St. Bernard deposits were of this latter species and some 58 per cent. of the

Donax variabilis, which is the small shell shown in plate III, f. In this illustration also is shown a large fragment of a pottery vessel *in situ*. The *Donax variabilis* is locally known as the "chip-chip" shell and is found in enormous numbers on the beach at certain times of the year. The present-day inhabitants gather these and make them into the locally renowned "chip-chip soup," a somewhat sandy delicacy greatly esteemed by the negro population. The aborigines undoubtedly used the chip-chip as one of their staple articles of diet and at those seasons when they were not found in abundance probably used the *Tivela mactroides*, which is found mostly on the sea beach north of Cape Mayaro and, strange to say, is hardly met with on the beach south of the Cape. Incidentally, the writer is of the opinion that the shells of this latter species were "steamed" in order to prepare them for food, in contrast to the chip-chip shells, which were boiled. He bases his contention on the fact that where the chip-chip shells are found clean and white in the deposits, the *Tivela mactroides* shells were always found in a blackened condition. The chip-chip shells are so small that "steaming" them would be out of the question and the only way they can be prepared is to cook them so as to detach the small animal from its shell.

The writer is indebted to Mr. L. P. Gratacap, of the American Museum of Natural History, for the identification of the shells found in the deposits and to Dr. F. A. Lucas, the director of the same institution, for the identification of some of the bones.

The sea shells found in the St. Bernard kitchen-middens are the following:

- Donax variabilis* Say.—58 per cent.
- Tivela mactroides* Born.—40 per cent.
- Ostrea cristata* Born.
- Pecten nodosum* Linnaeus.
- Scapharca brasiliiana* Lamarck.
- Lucina jamaicensis* Lamarck.
- Tellina interrupta* Wood.
- Labiosa canaliculata* Say.
- Dione veneris* Argenville.
- Melongena melongena* Linnaeus.
- Melongena morio* Linnaeus.

Strombus gigas Linnaeus.

Cypraea exanthema Linnaeus.

Astridium tuber Linnaeus.

Of fresh-water shells the following two varieties were found:

Ampullaria spixii Orbiguy.

Ampullaria cornu-sarietis Linnaeus.

One species of land-shell was found, that of the

Strophocheilus (Borus) oblongus Miller.

Besides these shells, a great number of fragments of madreporic coral were found in the deposits.

Of the bones, those that were identified were of the

Deer—*Odocoileus gymnotis*, of the

Collared peccary—*Pecari angulatus angulatus* and of the

Green turtle—*Chelone mydas*.

A number of bones were found of fishes and of some of the smaller mammals which were not identifiable. The St. Bernard deposits also produced a number of crab carapaces and claws and the large crabs found in this neighborhood are even today a favorite food of the inhabitants.

Unlike on the island of Margarita, no split human bones were found in the shell-heaps. The writer found two burials in the middens and the skeletons were found in such a bunched-up position that he came to the conclusion that the dead had been placed in a contracted position, and probably had been buried in their house site. This was not an uncommon practice of the Antilleans and it was usual to afterwards abandon the house and move to another spot.¹ The two burials in question were found in a layer of sea sand under and above which were the usual shell- and ash-layers, evidence that the village site had been used before and after the deaths had taken place. It was not possible to preserve the brittle bones, but, judging from the skull fragments, the heads had been artificially flattened. The writer was especially struck by the appearance of the teeth of both skeletons: they were quite

¹ Fewkes, J. Walter, "Relations of Aboriginal Culture and Environment in the Lesser Antilles," *Bulletin of the American Geographical Society*, vol. XLVI, no. 9 (September, 1914), page 673.

ground down, as in the case of very aged persons, yet did not show a trace of decay.

Some six miles to the south of the St. Bernard estate, on a property called Lagon Doux, also belonging to Mr. Paul Urich, the writer was shown another shell deposit on the southeastern slope of a hill about four hundred feet high and lying a mile inland from the sea beach. These deposits, however, were not thick enough to warrant the conducting of excavations and, due to centuries of rainfall, the middens had been washed down the slope of the hill and distributed over a large area with a resulting breaking-up of the objects into small fragments. A number of shallow deposits were also found by the writer on the extremity of Cape Mayaro, some three hundred feet above sea level. A cursory examination was enough to show that the deposits were too shallow to produce objects that would make excavating worth while.

On the Cocal property, about four miles to the north of Cape Mayaro, the writer discovered an isolated shell-heap, twelve feet high with a diameter of about fifty-five feet, composed almost exclusively of the shells of *Tivela mactroides*. This shell-heap presented a curious problem to the investigator, as its height and isolation made it prominent in the landscape. Shallow shell-deposits were found bordering it on all sides but, as in the previously cited cases, the writer did not consider it worth while to excavate in any of these, although test holes and small sherds on the surface of the ground proved conclusively that an Indian occupation had existed here. A ten-foot trench was dug through the isolated mound north and south and another ten-foot trench east and west, forming a cross over the summit of the mound. While a large number of small pottery sherds had been found on the surface of the ground in all directions from the mound, not a single sherd was found in the mound itself. Three hammerstones were found and two small pieces of rock-crystal, the latter evidently having been brought there from the northern mountain range of the island of Trinidad, the only place on the island where these crystals are found according to reputable local geologists. It will be seen, therefore, that this isolated mound, exclusively composed of shells,

in which no ashes, or bones and practically no artifacts were found, presents a curious problem compared to the other shell-deposits on the east coast of Trinidad, a problem which the writer is not able to solve.

ARCHAEOLOGICAL RESULTS FROM THE EXCAVATIONS

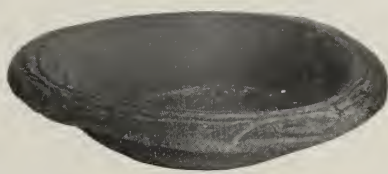
The most typical of all the various pottery vessels found in the St. Bernard middens is a shallow bowl form with a broad angular rim. It is safe to say that of the sherds found, at least 75 per cent. indicated that they belonged originally to a vessel of this type and this form, therefore, in its many variations, can be taken as being typical of the east coast region of Trinidad.

The simplest form of vessels of this type is the small bowl *a* shown on plate IV. This little dish has a main diameter of $7\frac{1}{4}$ inches and an inside diameter of $5\frac{1}{2}$ inches and its height is $1\frac{7}{8}$ inches. The angular rim itself is $\frac{7}{8}$ inch wide and was covered with a red paint by the potter on the upper surface. The body of the bowl is of a buff color and the paint on the rim was probably applied after the firing of the vessel and can easily be washed off. The pottery is $\frac{3}{8}$ inch thick. It must be noted that in all vessels of this type the height of the vessel is from $\frac{1}{3}$ to $\frac{1}{4}$ of its outside diameter. The base of this type of vessel is invariably flat but, judging from sherds found, was in some instances extended into a circular stand to give added stability to the vessel. While the specimen illustrated has a painted rim, a large number of bowls of this type were found of which the rim had not been painted and was of the same color as the vessel proper. This then is the simplest form of the type under discussion.

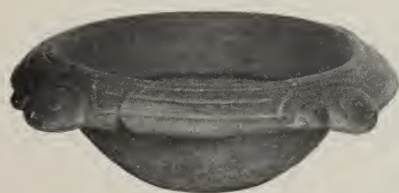
The next addition to the decoration of this type of bowls are the handles and an astonishing variety of forms of the latter were met with in the St. Bernard deposits. In plate V, *a*, can be seen one of these bowls to which has been added two loop handles of a somewhat elaborate pattern. Outside of this addition the bowl does not differ materially from the one previously described, excepting that it is far larger. The diameter of the bowl itself is 12 inches and its depth 4 inches. The thickness of the pottery is $\frac{3}{8}$ inch and the ware is buff colored.



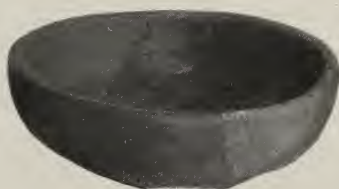
a



b



c



d



e



f

POTTERY VESSELS FROM ST. BERNARD MIDDENS

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Then again, the potter took the plain bowl of this type and added a design of incised lines to the rim. The simplest form of this were from one to six concentric lines running around the rim. In plate IV, *b*, can be seen a small bowl to which the potter, by way of decoration, has added two incised lines running concentrically around the rim and four extra semi-circular lines from the outside incised lines to the outside of the rim. The main diameter of this small bowl is 7 inches and the inside diameter $5\frac{1}{2}$ inches: the height is $1\frac{3}{4}$ inches and the ware $\frac{3}{8}$ inch thick. This bowl is reddish-brown in color.

In addition to the incised lines, the potter occasionally added nodes or lugs on the rim and an example of this decoration is shown on plate IV, *c*. The rim of this specimen has concentric incised lines and four nodes which are placed equidistant. The nodes probably represent highly conventionalized heads. The specimen under discussion has an outside diameter of $8\frac{1}{2}$ inches, an inside diameter of $5\frac{3}{4}$ inches and stands $2\frac{3}{4}$ inches high. The ware is $\frac{3}{8}$ inch thick and the vessel is buff-colored.

The most highly decorated form of all is where in addition to the incised lines on the rim, handles of various forms have been added. While only a comparatively small part of the bowl shown on plate V, *b*, was recovered, this specimen may serve to illustrate the highest development of decoration of the type of vessel under discussion. This specimen has an angular rim upon which incised lines have been carved. Furthermore, nodes have been added to the rim and besides these, a handle representing a conventionalized human head. This head is quite massive and it is permissible to state that another head of the same type must originally have opposed it on the rim. The original diameter of this bowl was 12 inches and its estimated height $4\frac{1}{2}$ inches. The ware is $\frac{3}{8}$ inch thick and reddish-brown in color.

A critical examination of all vessels with angular rims found in the St. Bernard shell-heaps will reveal the fact that each and every one of them can be classified under one of the vessels described above. The vessels range in size from some with an outside diameter of 3 inches and a height of 1 inch to the largest with an outside diameter of $16\frac{1}{2}$ inches and a height of 5 inches.

Yet another type of bowl was found to occur frequently in the deposits and one of these is shown on plate v, *c*. This, of course, is the simplest form of round vessel that it is possible for a potter to make. A number of small differences in outline can be found but fundamentally, the bowls are of course the same. The specimen illustrated has a diameter of 10 inches and a height of $3\frac{1}{4}$ inches. The ware is $\frac{3}{8}$ inch thick and is of a gray-brown color. The rim is slightly thicker than the base part of the vessel. The base of this bowl is indented. The inside of this vessel is partly covered with pitch or manjak, and the writer has already mentioned the occurrence of this latter substance in the shell-heaps. He does not believe that in the case of the illustrated vessel this pitch was employed to mend a break in the bowl, as to his mind, in that event the pitch would have probably been applied to the outer surface of the bowl. The writer presumes that the vessel must have been used as a container for the molten pitch. A number of sherds were discovered, however, that had the pitch applied to the inner and to the outer surface, and cases were met with where the vessel showed signs of having been cracked under the pitch-layers. It is permissible therefore to assume that the aborigines were in the habit of mending their cracked vessels with layers of pitch to strengthen the cracked place and to make the vessel liquid-tight.

A slight variation on this type of shallow bowl is shown on plate iv, *d*, where the convex basal part of the vessel is topped by a perpendicular rim. This rim is $1\frac{1}{2}$ inches high and has been painted red on the in- and on the outside. The body of the bowl is yellow and the entire vessel stands $2\frac{3}{8}$ inches high. The diameter of the bowl is 6 inches, and the ware is $\frac{1}{4}$ inch thick.

This type of vessel, of which the two specimens described above can be considered typical samples, occurred in large quantities in the middens. Occasionally the rim was thickened or painted and the vessels ranged in size from a diameter of $3\frac{3}{4}$ inches (the smallest specimen of this kind found) to a diameter of $13\frac{1}{2}$ inches.

Perhaps the most unusually shaped vessel found in the St. Bernard deposits is the one illustrated on plate v, *d*. The writer knows of no other vessel like it from the West Indies and considers



a



b



c



d

POTTERY BOWLS FROM ST. BERNARD

the form unique. The handles of this four-cornered bowl undoubtedly represent the heads of the armadillo, an animal that is frequently found in Trinidad and that is considered a great delicacy by the natives. It may be mentioned that a large number of heads were found in the shell-heaps that represented the armadillo and we judge from this that it was a favorite practice of the aborigines living around Mayaro to thus ornament their pottery vessels. Incised circles ornament the two other terminals of the vessel under discussion and an incised cross can be seen in the one, while the opposite circle contains twelve impressed pits. The bowl is not well made as far as symmetry is concerned. It has a flat base and stands 5 inches high at the rounded terminals. The length of the vessel across the heads is $13\frac{1}{4}$ inches and it has a short axis of $10\frac{1}{4}$ inches. The ware is quite thin for such a large vessel, $\frac{1}{4}$ inch. The color of the bowl is buff. Between the heads and the rounded terminals can be seen panels of incised decorations. There is a small lug on either side of the heads and another lug below the incised circle of the rounded terminals.

Another vessel of elaborate pattern is that shown on plate IV, *e*, a fragment of which is also illustrated *in situ* in plate III, *f*. It is likely that this is one of the so-called turtle-bowls, judging from the shape and design of the incomplete vessel. The head of the turtle can still be seen, but the tail is missing. The four rounded parts of the rim—of which three remain—represent the flippers of the turtle in a conventionalized manner and the outside of these flippers have been decorated with cross-hatched incisions and covered with a dark-red slip of pigment on the in- and on the outside. The rounded parts of the rim are surmounted by a small lug with two incisions. The base of this vessel is flat. The diameter of this bowl is 7 inches and it stands 2 inches high where the head is and $3\frac{1}{4}$ inches at the highest point of each flipper. The ware is $\frac{1}{4}$ inch thick and the body of the bowl is painted yellow.

On plate IV can be seen another unusual bowl, *f*, of which but a fragment was found. This vessel originally must have been rectangular in shape and has a flat, round base. A grotesque human head serves as handle at the one end and it would be inter-

esting to know whether the other terminal was provided with a handle and if so, what shape it had. An incised line surrounds the rim on the outside and the rim has been covered with a dark-brown slip of pigment, also on the outside. The grotesque head also has been covered with this dark-brown pigment. The vessel has a width of $6\frac{1}{2}$ inches and an estimated length of about 8 inches. The height is $2\frac{1}{2}$ inches and the ware, brown in color, is $\frac{3}{8}$ inch thick.

The small vessel illustrated on plate VI, *a*, is unusual in so far that it reminds us more of the pottery from Santo Domingo and Porto Rico with its incised decoration surrounding the rim in a geometrical pattern. The outline of this vessel was restored from the fragments found and it cannot be determined whether the base was flat or rounded. The largest diameter of this bowl is $4\frac{3}{4}$ inches and the diameter of the mouth $3\frac{3}{4}$ inches. The ware is $\frac{3}{8}$ inch thick and the bowl is brown in color.

The flat, discoidal-shaped vessel with the comparatively small mouth illustrated on plate VI, *c*, recalls to our mind the sea-urchin and it may well be that the potter derived the contour of this bowl from the shape of this animal. This vessel is unique in shape as far as the West Indies are concerned and no other fragments of like vessels were found in the St. Bernard deposits. The little bowl stands but $2\frac{1}{2}$ inches high and its largest diameter is $6\frac{1}{4}$ inches, while the diameter at the mouth is $3\frac{1}{2}$ inches. The thickness of the ware, which is brown in color, is $\frac{1}{4}$ inch. An incised line surrounds the mouth of the vessel and forms the only decoration.

The smallest vessel found is the one illustrated on plate VI, *b*, which stands but 2 inches high. It can hardly be supposed that this miniature vessel was intended for a container. The vessel is provided with two small, perforated lugs. An incised line surrounds the rim and two more incised lines the body of the vessel. The ware is brown in color and $\frac{1}{4}$ inch thick. No sherds were found of other vessels of this small size.

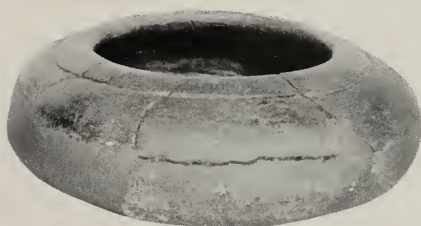
A number of double paint-bowl vessels were found in varying sizes and the smallest of these is illustrated in plate VI, *d*. The length of this specimen is $4\frac{3}{8}$ inches and the height $1\frac{1}{2}$ inches. The ware is brown in color and $\frac{3}{16}$ inch thick. There is a small lug on each side of the wall separating the two bowls.



a



b



c



d



e



f

POTTERY OBJECTS FROM ST. BERNARD REFUSE HEAPS

The small perforated globular object with the incised lines, shown on plate VI, *f*, is either a pottery bead or else was used as a spindle whorl. This is the only specimen of this kind recovered from the Mayaro kitchen middens.

A very large number of pottery heads and handles were excavated in the shell-heaps. These do not differ materially from those illustrated in Dr. Fewkes' paper on the archaeology of Trinidad¹ or from those figured in the writer's paper on the archaeology of Margarita Island.² The heads shown in Dr. Fewkes' paper, from Erin Bay on the south coast of Trinidad are of a slightly coarser manufacture, but resemble the Mayaro specimens in type. It may be noted in this connection that all the St. Bernard pottery was of a more delicate finish than that from Erin Bay and the vessels were not as thick as the vessels collected by Dr. Fewkes. The writer only figures two of the heads collected in the St. Bernard deposits, as these two heads are uncommon in type and are of a variety not previously figured. Specimen *a*, plate VII, is an extremely massive head and larger than the usual types and represents a conventionalized human head. The mouth and the eyes are depicted by incised lines: small impressed pits serve to indicate the nostrils and the ears also have pits to indicate perforations. This specimen stands 4 inches high and is dark-gray in color. Specimen *b* of plate VII is a flat handle and also represents a conventionalized human head. No other specimen like it was found or is known to the writer, from the West Indies. The head is flanked by large scroll-like ornaments. The forehead is ornamented with cross-hatched incisions, as is the back of this handle. The height of this specimen is $3\frac{3}{4}$ inches and it is dark-brown in color.

An extremely large number of spool-shaped pottery rests were found, of varying sizes and two of these objects, *c* and *d*, are illustrated on plate VII. *c* has an inside diameter of $2\frac{5}{8}$ inches and an outside diameter of $4\frac{1}{4}$ inches and stands $1\frac{1}{2}$ inches high. The ware is $\frac{3}{8}$ inch thick and is brown in color, covered with a red slip of pigment. *d* has an inside diameter of $2\frac{1}{2}$ inches, an outside diam-

¹ Fewkes, J. Walter, *op. cit.*, plates XVI, XVII, XVIII, and XIX.

² Booy, T. de, *op. cit.*, plate II.

eter of $4\frac{5}{8}$ inches and stands $2\frac{1}{2}$ inches high. The ware is $\frac{1}{2}$ inch thick and is brown in color covered with a red slip. Incised lines decorate the body of this rest. On *c* can be seen single and double nodes which are placed symmetrically around the rim of the object. Some of the pottery rests found were ring- instead of spool-shaped and an astonishing variety of ornamentation was found in the objects of this class.

The writer has purposely left a discussion of the highly decorated painted pottery to the last. It has already been stated that many of the vessels and sherds found showed that a superficial slip or wash of paint had been applied to the ware. This, however, had either been applied after the firing of the clay or else had been ap-

plied before the firing and had not become a very substantial part of the ware. A very large number of fragments were found, however, upon which was found a heavy slip of solidly-applied pigment in geometrical designs and these fragments seem to have been subjected to great heat in the firing and are far less brittle than the specimens previously described. Three of these sherds were found on Margarita Island¹ and these sherds



FIG. 62.—Pottery monkey head.

were identical with some eight hundred fragments found in the St. Bernard middens. It must be noted that on no other part of Trinidad have sherds of this class been found to the writer's knowledge. What makes the finding of this kind of pottery all the more interesting to the archaeologist is the fact that it was not possible to reconstruct a single vessel from the sherds found: not only were no sherds of one same vessel found but no two sherds were found even that fitted on to each other. In the object illustrated in fig. 62, the reader will note the presence of "breaks" in the object, but these breaks

¹ Booy, T. de, *op. cit.*, page 20, fig. 7.



a



b

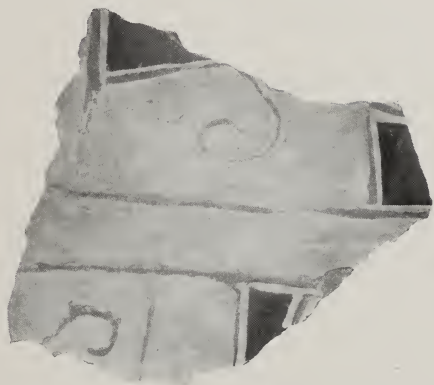


c



d

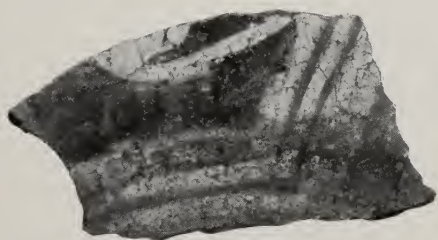
POTTERY HEADS AND POTTERY RESTS FROM ST. BERNARD MIDDENS



a



b



c



d



e



f

POTSHERDS, LUGS, AND POTTERY HEADS FROM ST. BERNARD MIDDENS

were the result of the excavation and not of the later matching together of the pieces. It would seem, therefore, as if the aborigines that made this particular class of pottery not only broke the vessels up, but took pains to distribute the resulting fragments over a large area. The writer can offer no explanation for this seemingly meaningless custom.

On plate VIII, *a* and *c* can be seen two of the sherds under discussion and a superficial examination will convince the reader that these sherds belong to a totally different class of pottery than the kind previously discussed. The ware appears to be far better baked and is not so fragile; the slip is thick and consists of red, brown, yellow, black and white pigment. The designs are applied

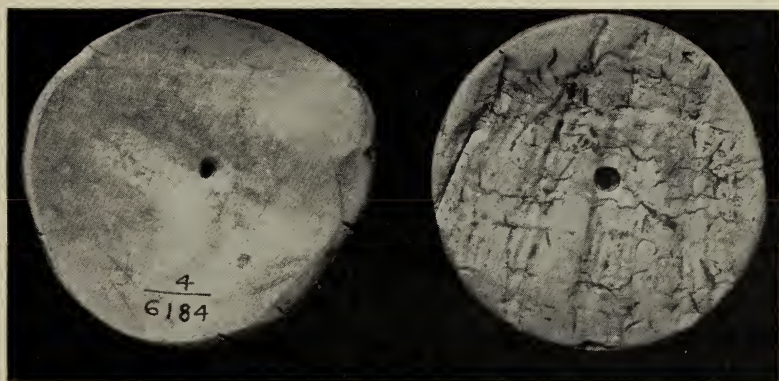


FIG. 63.—Large shell-disks.

in geometrical patterns and it is to be regretted that not enough of one design is left on any one sherd to enable the writer to work it out. The vessels were frequently provided with handles, upon which the potter also placed a painted design. One of these handles is illustrated on plate VIII, *b*. Nodes or lugs also were added to the vessels; one of these is shown on plate VIII, *d*. Then again some the vessels must have had pottery-heads, of which a grotesque sample is shown in *f* of the same plate. Another head, *e*, is also shown, which head was part of the base of a vessel.

Judging from a number of the sherds found, some of the vessels served as containers for liquids and had a highly ornamented head

on top of the vessel proper which served as a spout. The best specimen found is shown in fig. 62 and probably represents a monkey head. Only two colors, white and red, were used to decorate the gray ware of this object, which stands 4 inches high.

The vessel shown on plate VI, *e*, does not belong by rights to the class of pottery described above, although it has received the same painted slip. The ware of this object however is brittle and not well baked and resembles the ware of the vessels first described in this paper. The decoration is red and white in geometrical design over a brown ware and the writer is inclined to believe that the potter intended this vessel to represent a turtle. Four nodes represent the flippers and the tail is shown. The head has been broken off. This vessel stands 4 inches high and has a main diameter of $5\frac{1}{2}$ inches. The diameter of the mouth is $1\frac{1}{4}$ inches.

A large number of fragments of pottery griddles for the baking of cassava bread were found in the shell-heaps, which fragments did not differ from objects of the same class found throughout the West Indies.

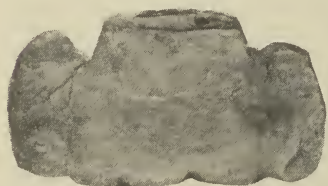


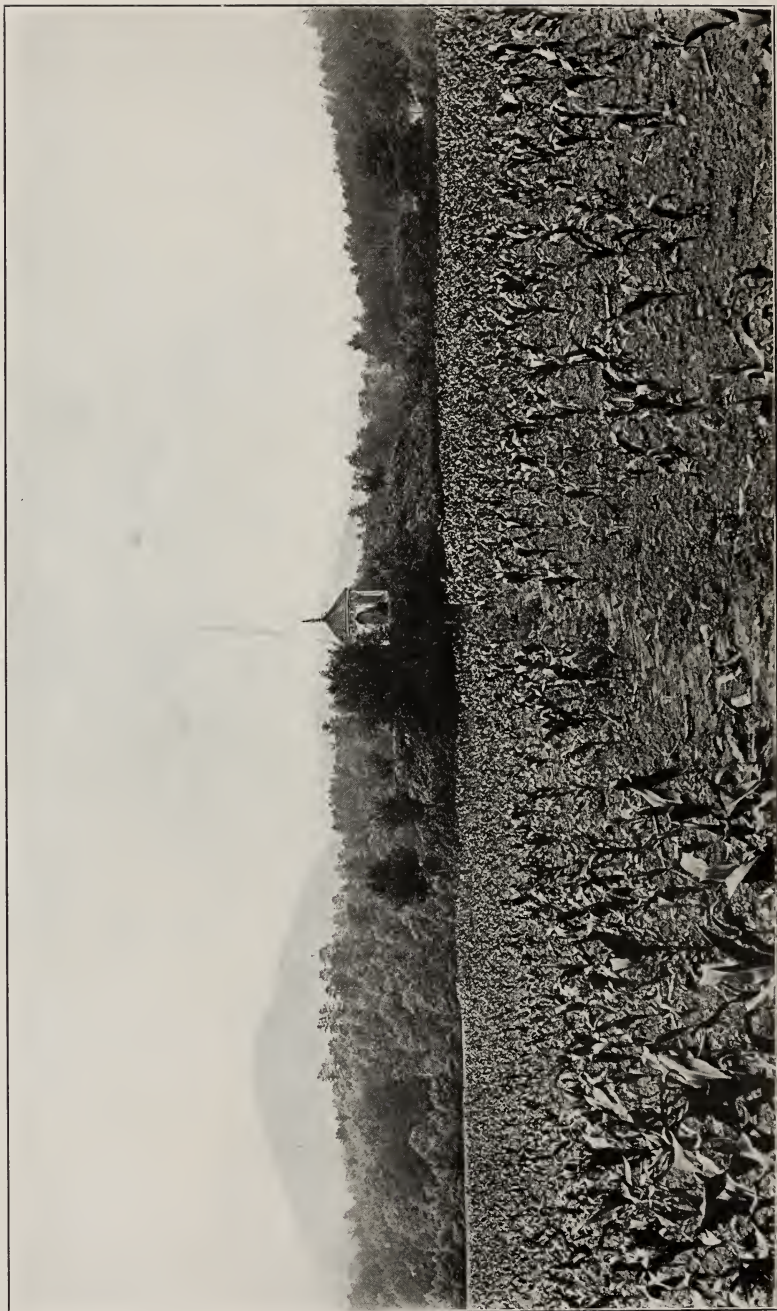
FIG. 64.—Pendant of Amazon stone.

Two large shell-disks were found, shown in fig. 63, which undoubtedly were objects of personal adornment. These disks or gorgets have a diameter of $2\frac{1}{4}$ inches and are about $\frac{3}{16}$ inch thick.

Yet another pendant ornament is shown in fig. 64. This little object is made of Amazon stone, is $1\frac{5}{8}$ inch long and 1 inch wide and $\frac{1}{8}$ inch thick.

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THE NACOOCHIE MOUND FROM THE NORTH; MOUNT YONAH IN THE DISTANCE

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Volume IV, Number 3

MAR 18 1919

THE NACOOCHEE MOUND
IN GEORGIA

BY
GEORGE G. HEYER, F. W. HODGE,
AND
GEORGE H. PEPPER

NEW YORK
MUSEUM OF THE AMERICAN INDIAN
HEYER FOUNDATION
1918

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A. NACOOCHEE MOUND FROM THE SOUTHEAST, BEFORE EXCAVATION



B. EXCAVATION OF A FOUR-FOOT SECTION FROM THE SUMMIT

THE NACOOCHEE MOUND IN GEORGIA

BY

GEORGE G. HEYE, F. W. HODGE, AND
GEORGE H. PEPPER

INTRODUCTION

IN the attractive little Nacoochee valley, drained by the extreme headwaters of the Chattahoochee between Sautee and Soquee creeks in White county, northeastern Georgia, and within the shadow of Mount Yonah which looms toward the southeast (pl. I), rises an artificial mound, slightly more than seventeen feet in maximum height, which forms a conspicuous landmark in the region. This earthwork, which stands about 300 yards north of the river, was excavated to a considerable extent in the summer of 1915 by a joint expedition of the Museum of the American Indian, Heye Foundation, and the Bureau of American Ethnology of the Smithsonian Institution. The slope of the mound was steep, and its base clearly marked from the surrounding field owing to extended cultivation during many years and the plowing away of the lower part of the sides (pl. II, *a*). Moreover, the top of the mound had also been plowed away years before to afford a level space for the erection of a summer-house and the planting of a garden, water for which had been piped from the adjacent residence, now the home of Dr L. G. Hardman, the owner of the land on which the earthwork is situated. In view of this change in the configuration of the mound and the fact that wear by the elements in this unusually wet region during a considerable period between its abandonment by the Indians and the settlement of Nacoochee valley by whites, the measurements made in 1915 do not indicate, perhaps within many feet, the original height and circumference.

Permission to excavate the Nacoochee mound was granted by Dr Hardman for a consideration mutually satisfactory and on

condition that its form be restored and any precious metals found during the progress of the work should be placed in the owner's hands. As in other parts of the country, the belief is prevalent in Georgia, even among educated people, that hoards of gold are hidden beneath earthworks reared by Indians in ancient times, and this belief is especially current in northern Georgia where gold was found in the early part of the last century, a mint being established at Dahlonega in 1838 and maintained for some years. A preliminary examination of the Nacoochee site was made in May, 1915; active operations were commenced on June 19 by Mr Heye and continued until July 2, when, during his absence of a few days, the excavation was in charge of Mr E. F. Coffin, of the Museum staff, who presented daily reports. Mr Hodge joined in the work early in July, from which time the excavations proceeded under the coöperation of himself and Mr Heye. Conditions necessitating the return of Mr Heye to New York and of Mr Hodge to Washington late in August, the work was continued from the 28th of the latter month until October 29 under the immediate charge of Mr Pepper, assisted by Mr Coffin. Thus the Nacoochee excavations were conducted uninterruptedly for a period of more than four months. While it has been found convenient for Mr Hodge to prepare this report, it must be understood as embodying not only the results of his own observations on the features of the site and of the artifacts found, but those of Messrs Heye and Pepper as well.

Although it was the intention to excavate the mound completely, conditions were such, especially those occasioned by excessive rainfall, that it was not possible to remove the entire earthwork during a single field season, and a satisfactory concession for the resumption of the work in the following summer could not be obtained from the owner. The present report, therefore, embodies the results of the excavation by the joint expedition, together with some information published by C. C. Jones in 1873, and such knowledge respecting the earlier history of Nacoochee as has come down to us.

HISTORY

Of the history of the Nacoochee site very little is known, and although the name itself is a corruption of the Cherokee form

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STONE GRAVE (BURIAL 34)

Nagu'tsǎ', "the meaning of the word is lost and it is doubtful if it be of Cherokee origin."¹ Mr Mooney suggests that the name may have some connection with that of the Yuchi Indians; and according to information communicated to the writer by the late H. S. Halbert, who possessed a wide knowledge of the Choctaw language, the term so closely resembles the Choctaw *nakúshi*, which signifies "little arrow," as to suggest Muskhogean derivation.

That Nacoochee was a village of the Cherokee Indians during historic times, there is no question. The settlement first became known to the Spaniards of the De Soto expedition, who visited it in the latter part of May, 1540. The narrations of this expedition have been summarized by Mr Mooney, so that it is not necessary for the purpose of this paper to present anew the accounts given by the chief chroniclers of that remarkable journey of the Spanish forces. Mr Mooney says:

"After several days of such travel they arrived, about the end of the month, at the town of Guasili, or Guaxule. The chief and principal men came out some distance to welcome them, dressed in fine robes of skins, with feather head-dresses, after the fashion of the country. Before reaching this point the queen [the chieftainess of Cofitachiqui, probably a Yuchi province and town, who had been made a prisoner] had managed to make her escape, together with three slaves of the Spaniards, and the last that was heard of her was that she was on her way back to her own country with one of the runaways as her husband. What grieved De Soto most was that she took with her a small box of pearls, which he had intended to take from her before releasing her, but had left with her for the present in order 'not to discontent her altogether.'

"Guaxule is described as a very large town surrounded by a number of small mountain streams which united to form the large river down which the Spaniards proceeded after leaving the place.² Here, as else-

¹ James Mooney, *Myths of the Cherokee*, *Nineteenth Annual Report of the Bureau of American Ethnology*, Vol. 1, pp. 526-527, Washington, 1902. Mr Mooney states that the name *Itsá'ti* likewise was applied to the Nacoochee mound, although primarily it was the proper form of Little Echota, on Little Tennessee river, and of Echota, on Sautee creek.

² The streams referred to, no doubt, are Soquee and Sauté creeks which unite to form the Chattahoochee. The principal mountains in the vicinity, peaks of the Blue Ridge, are Mount Yonah, Sall's Mountain, and Lynch's Mountain.

where, the Indians received the white men with kindness and hospitality—so much so that the name of Guaxule became to the army a synonym for good fortune. Among other things, they gave the Spaniards three hundred dogs for food, although, according to the Elvas narrative, the Indians themselves did not eat them. The principal officers of the expedition were lodged in the ‘chief’s house,’ by which we are to understand the townhouse, which was upon a high hill with a roadway to the top. From a close study of the narrative it appears that this ‘hill’ was no other than the great Nacoochee mound, in White county, Georgia, a few miles northwest of the present Clarkesville. It was within the Cherokee territory, and the town was probably a settlement of that tribe. From here De Soto sent runners ahead to notify the chief of Chiaha of his approach, in order that sufficient corn might be ready on his arrival.”¹

“In five days of such travel—for here, for a wonder, all the narratives agree—they came to Guaxule. This is the form given by Garcilaso and the Gentleman of Elvas; Biedma has Guasula, and Ranjel Guasili or Guasuli. The translators and commentators have given us such forms as Guachoule, Quaxule, Quaxulla, and Quexale. According to the Spanish method of writing Indian words, the name was pronounced Washulé or Wasuli, which has a Cherokee sound, although it can not be translated. Buckingham Smith (Narratives, p. 222) hints that the Spaniards may have changed Guasili to Guasule, because of the similarity of the latter form to a town name in southern Spain. Such corruptions of Indian names are of frequent occurrence. Garcilaso speaks of it as a ‘province and town,’ while Biedma and Ranjel call it simply a town (*‘pueblo’*). Before reaching this place the Indian queen had managed to make her escape. All the chroniclers tell of the kind reception which the Spaniards met here, but the only description of the town itself is from Garcilaso, who says it was situated in the midst of many small streams which came down from the mountains round about, that it consisted of three hundred houses, which is probably an exaggeration, though it goes to show that the village was of considerable size, and that the chief’s house, in which the principal officers were lodged, was upon a high hill (*‘un cerro alto’*), around which was a roadway (*‘paseadero’*) wide enough for six men to walk abreast. By the ‘chief’s house’ we are to understand the townhouse, while from various similar references in other parts of the narrative there can be no doubt that the ‘hill’ upon which it stood was an artificial mound. In modern Spanish writing such artificial

¹ Mooney, op. cit., pp. 25–26.

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STONE GRAVE (BURIAL 39) BEFORE AND AFTER REMOVAL OF THE COVERING SLABS

elevations are more often called *lomas*, but these early adventurers may be excused for not noting the distinction. Issuing from the mountains round about the town were numerous small streams, which united to form the river which the Spaniards henceforth followed from here to Chiaha, where it was as large as the Guadalquivir at Sevilla.”¹

Nacoochee seems also to have been visited by Juan Pardo in 1567, if we may identify his “Cauchi” with the name of that settlement, which is possible but not certain.²

The settlement is mentioned by Bartram,³ under the name Nae oche, an evident misprint of Nacoeche, as among the forty-three towns of the Cherokee in 1776; and it appears as Naguchee, between Echotee and Cussatee, on “An Accurate Map of North and South Carolina,” etc., by Henry Mouzon and others, 1775, in Thomas Jefferys’ American Atlas, map 23, London, 1776. It does not appear, however, in a list of fifty-one settlements in a distribution roll of Cherokee annuities of 1799,⁴ although this omission is not to be regarded as conclusive evidence that Nacoochee did not exist at that time. The Nacoochee valley was on the free public road laid out between 1813 and 1815 which extended from Tennessee river to the head of navigation on the Tugaloo branch of Savannah river, which became the great highway from the coast to the Tennessee settlements.⁵ The valley was included in the great area of land ceded by the tribe to the United States by the treaty of Washington, February 27, 1819,⁶ following the treaty of July 8, 1817, by which the Cherokee ceded their lands lying east of the Chattahoochee in Georgia, hence it probably was not very long after that time that the Cherokee abandoned this and various other villages, when their removal first to Arkansas, thence to the present Oklahoma, was commenced. By the treaty of December 29, 1835, all the remaining lands of the Cherokee east of the Mississippi were relinquished to the Government.

¹ Mooney, *ibid.*, pp. 195-196.

² Mooney, *ibid.*, p. 29.

³ William Bartram, *Travels through North and South Carolina, and Georgia, etc.*, p. 372, London, 1792; also Dublin, 1793.

⁴ C. C. Royce, *The Cherokee Nation of Indians, Fifth Annual Report of the Bureau of Ethnology*, p. 144, Washington, 1887.

⁵ Mooney, *op. cit.*, p. 87.

⁶ Royce, *op. cit.*, pp. 219 ff.

The time when the Cherokee still occupied the Nacoochee valley was within the memory of old inhabitants who have passed away within the last few years, while it is written of George W. Williams, of Charleston, S. C., that in 1823 his father removed from North Carolina to the Nacoochee valley, then "on the very border of civilization, inhabited principally by Cherokee Indians"; and, again, that his father, "who was one of the original settlers here about the time the Indians were driven away, owned a large portion of Nacoochee valley, taught his sons the science of farming; they ploughed up gunlocks, swords, broken shells, bullets, tomahawks, arrows, human bones and the like."¹ The two statements may not be entirely consistent, but they suggest the occupancy of the valley by the Cherokee for a short time after the treaty of 1819. Further evidence that the settlement was not abandoned until well within the nineteenth century is afforded by the finding by us of a Spanish coin of Carlos IV, dated 1808, in the refuse under the northeastern base of the mound.

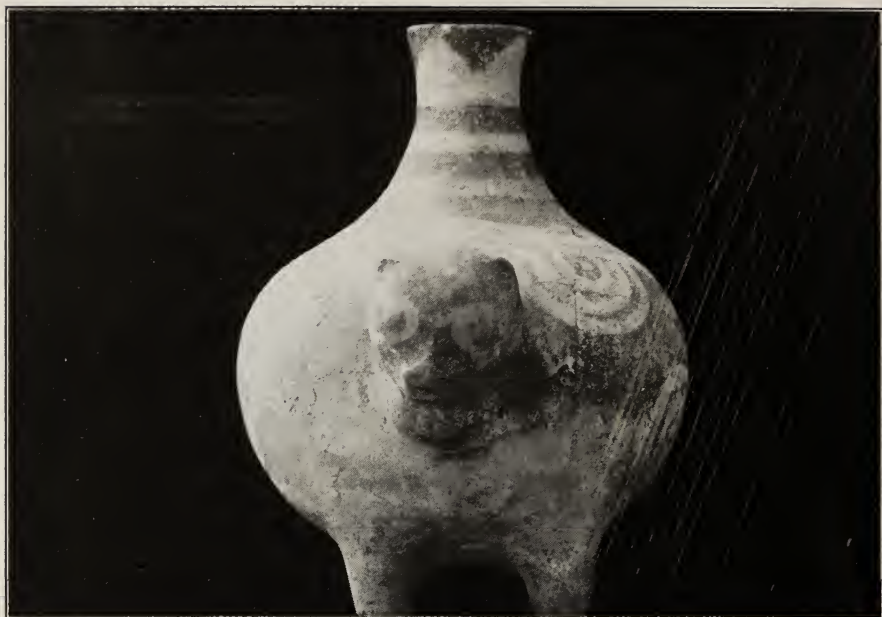
Although not the earliest account of the so-called "Indian legend" of Nacoochee,² that of Williams is probably most responsible for the exploitation of the ridiculous yarn, set forth as of Indian origin, respecting the beautiful Nacoochee and her Choctaw lover Sautee, after whom the two streams bearing those designations are alleged to have been named. The Spaniards of De Soto's army are forced into the romance, and although there is not a grain of truth in the assertion that any Indians ever related such an un-Indian legend, and the entire fabric of the story is imaginary, it has received such currency that no argument can dismiss it from the minds even of those otherwise intelligent. It is not improbable that the myth of the Indian "princess" may have had its origin in the "queen" of Cofitachiqui who ran off with one of the negro slaves of the Spaniards as her husband.

¹ George W. Williams, *Relics of a Forgotten Race in Nacoochee, Ga., and Its Surroundings*, pp. 70, 95, Charleston, 1903.

² See the romance of the "Indian Princess Nacoochee, 'The Evening Star,'" in Rev. George White's *Historical Collections of Georgia*, pp. 486-487, New York, 1854.

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EFFIGY VASE FROM THE NACOOCHEE MOUND

CHARACTER OF THE MOUND

Fortunately a description of the condition of the Nacoochee mound forty-five years ago was recorded by Charles C. Jones,¹ whose observations are worthy of repetition here for the sake of comparison.

"In the upper part of Nacooche valley, and near its western extremity, is a prominent earth-mound. Located not far from the Chattahoochee river, and rising some 20 feet or more above the surface of the surrounding valley, it has long constituted a marked feature in this beautiful region. For many years its slopes and summit have been cultivated, and, within the recollection of the older inhabitants, this tumulus has lost much of its original dimensions. [More or less] elliptical in shape, it has a flat top, declining somewhat toward the southwest. Measured in a northeasterly and southwesterly direction, at right angles, its base-diameters are, respectively, 190, and 150 feet; while its apex-diameters, ascertained in the same directions, do not fall short of 90 and 60 feet. It is entirely artificial, and appears to be wholly composed of the earth gathered from the neighborhood of its base. There are no terraces, the sides sloping gradually from the summit. Tradition has preserved no memories of the people by whom it was erected, and its treasures, if any, are still concealed within its own bosom."

A survey of the mound by Mr Heye and Mr Coffin before excavation was commenced, showed its N.E.-S.W. diameter on the summit to have been 78 ft. and its N.W.-S.E. diameter 67 ft. 4 in., which latter was the minimum diameter of the apex. The maximum diameter of the top, however, was 82 ft. 9 in. from north to south. The shape of the summit is shown in fig. 1, which represents a circumference of about 231 feet. The circumference as measured at the base was 410 ft., while the maximum height of the mound was 17 ft. 3 in. As before indicated, these measurements are of interest only as showing the condition before excavation, and by no means represent the dimensions of the mound at the time of its abandonment. As Jones remarks, there was no sign of a terrace or roadway, such as that which characterized the ancient Guaxule. Little was to have been expected in the way of remains at the surface of the summit, as it was learned from a mechanic who had

¹ *Antiquities of the Southern Indians*, pp. 213-214, New York, 1873.

been employed in building the pagoda, still preserved, twenty-seven years before, that about two feet of the top had been removed at that time. Subsequently the sides had been dug away more or

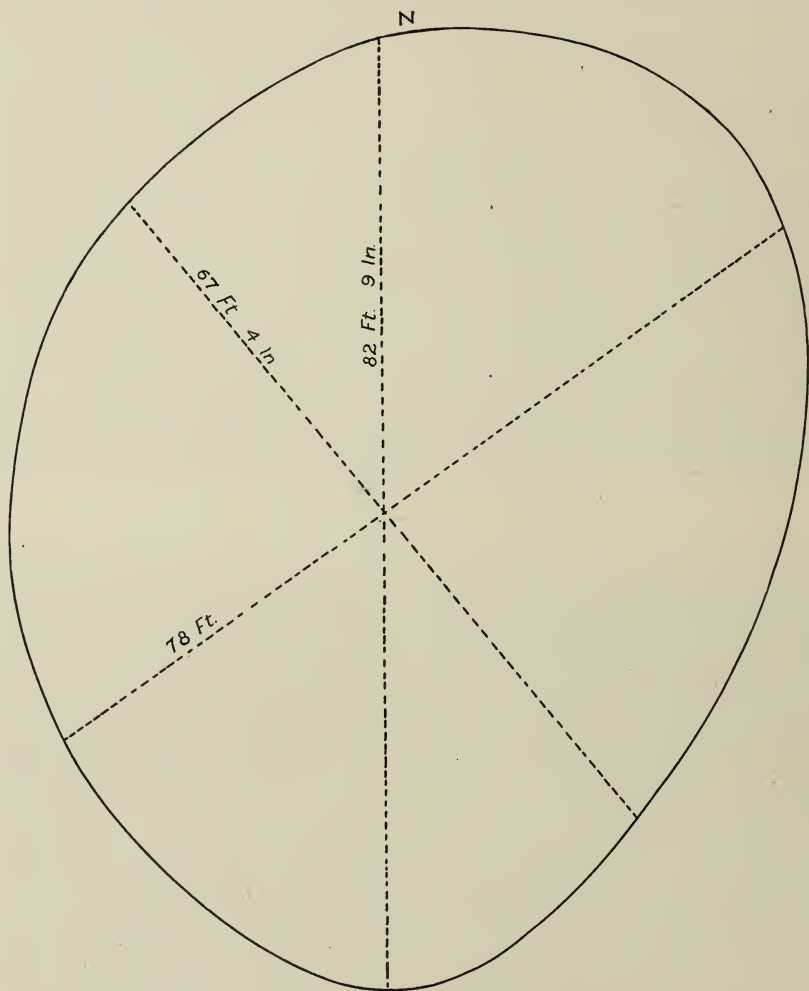


FIG. 1.—Outline of the summit of the Nacoochee mound at the time of excavation.

less, forming a steep conventional terrace which was planted in vines and shrubbery, and the mound fenced.

As mentioned by Jones, the mound is composed mainly of earth

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EFFIGY VASE FROM TENNESSEE
COURTESY OF PROF. L. C. GLENN, OF VANDERBILT UNIVERSITY, NASHVILLE

taken from the surrounding field, which consists of a rich dark clayey soil containing a considerable proportion of silica and alumina. It was early observed in the course of the excavation that this soil became bright red on contact with fire, the change in color being especially apparent in the numerous evidences of fire-pits throughout the mound. An analysis by Dr Edgar Everhart, chemist of the Geological Survey of Georgia, made by the courtesy of Prof. S. W. McCallie, State Geologist, gave the following result:

Moisture at 100° C.....	3.02
Loss on ignition H ₂ O and organic matter.....	10.38
Soda (Na ₂ O).....	.64
Potash (K ₂ O).....	2.05
Lime (CaO).....	1.00
Magnesia (MgO).....	1.80
Alumina (Al ₂ O ₃).....	17.77
Ferric oxide (Fe ₂ O ₃).....	4.48
Ferrous oxide (FeO).....	1.44
Manganous oxide (MnO).....	.20
Titanium dioxide (TiO ₂).....	1.35
Sulphur trioxide (SO ₃).....	.08
Phosphorus pentoxide (P ₂ O ₅).....	.72
Silica (SiO ₂).....	54.64
Organic matter about 0.50%.....	
Total.....	99.57

The purpose of the Nacoochee mound was primarily domiciliary, that is, as in the case of so many earthworks in the South, it was the site of the town-house, the dwellings of the village proper being erected in the surrounding flat land. A glimpse of a typical settlement of the Cherokee in the eighteenth century, before these tribesmen had become greatly modified by contact with encroaching civilization, may aid us in visualizing the conditions existing at Nacoochee at the time of its occupancy. William Bartram, a man of scientific attainments, who visited a number of Cherokee settlements during a journey through the South in 1773-78, wrote as follows on the subject of Cherokee houses, his description, although evidently applying especially to the village of Cowee, situated at the mouth of Cowee creek of Little Tennessee river, in Macon

county, N. C., being characteristic of Cherokee towns in general.¹

"The Cherokees construct their habitations on a different plan from the Creeks; that is, but one oblong four square building, of one story high; the materials consisting of logs or trunks of trees, stripped of their bark, notched at their ends, fixed one upon another, and afterwards plaistered well, both inside and out, with clay well tempered with dry grass, and the whole covered or roofed with the bark of the chesnut tree or long broad shingles. This building is however partitioned transversely, forming three apartments, which communicate with each other by inside doors; each house or habitation has besides a little conical house covered with dirt, which is called the winter or hot-house; this stands a few yards distance from the mansion-house, opposite the front door.

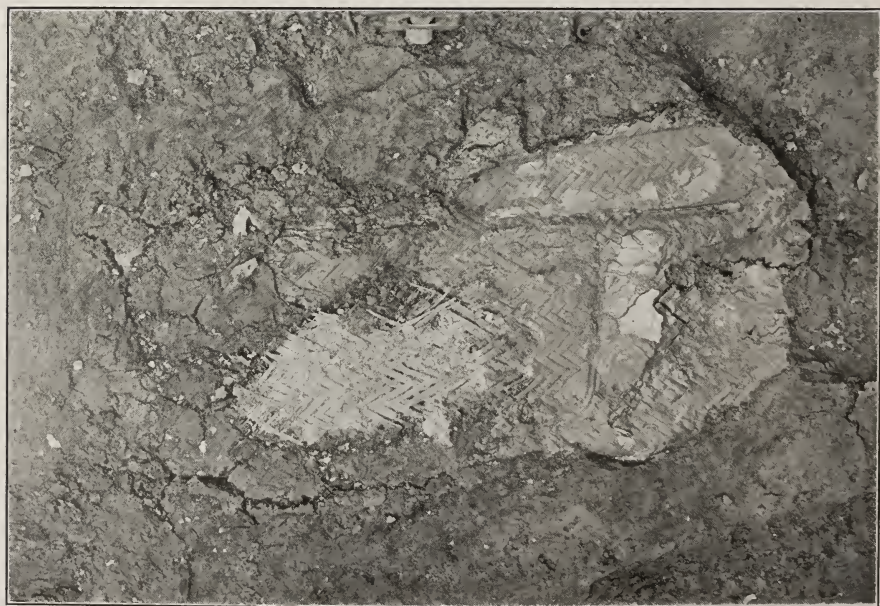
"The council or town-house is a large rotunda, capable of accommodating several hundred people: it stands on the top of an ancient artificial mount of earth, of about twenty feet perpendicular, and the rotunda on the top of it being above thirty feet more, gives the whole fabric an elevation of about sixty feet from the common surface of the ground. But it may be proper to observe, that this mount on which the rotunda stands, is of a much ancients date than the building, and perhaps was raised for another purpose. The Cherokees themselves are as ignorant as we are, by what people or for what purpose these artificial hills were raised; they have various stories concerning them, the best of which amount to no more than mere conjecture, and leave us entirely in the dark; but they have a tradition common with the other nations of Indians, that they found them in much the same condition as they now appear, when their forefathers arrived from the West and possessed themselves of the country, after vanquishing the nations of red men who then inhabited it, who themselves found these mounts when they took possession of the country, the former possessors delivering the same story concerning them: perhaps they were designed and appropriated by the people who constructed them, to some religious purpose, as great altars and temples similar to the high places and sacred groves anciently amongst the Canaanites and other nations of Palestine and Judea.

"The rotunda is constructed after the following manner: they first fix in the ground a circular range of posts or trunks of trees, about six feet high, at equal distances, which are notched at top, to receive into them from one to another, a range of beams or wall plates; within this is another circular order of very large and strong pillars, above twelve feet

¹Op. cit., pp. 365-366.

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MATting FOUND WITH BURIAL 46

THE LOWER FIGURE SHOWS THE IMPRESSION OF THE COPPER AXE AND ITS HANDLE BENEATH THE MATting

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COPPER AXE WITH PART OF ITS WOODEN HANDLE

high, notched in like manner at top, to receive another range of wall plates; and within this is yet another or third range of stronger and higher pillars, but fewer in number, and standing at a greater distance from each other; and lastly, in the center stands a very strong pillar, which forms the pinnacle of the building, and to which the rafters centre at top; these rafters are strengthened and bound together by cross beams and laths, which sustain the roof or covering, which is a layer of bark neatly placed, and tight enough to exclude the rain, and sometimes they cast a thin superficies of earth over all. There is but one large door, which serves at the same time to admit light from without and the smoak to escape when a fire is kindled; but as there is but a small fire kept, sufficient to give light at night, and that fed with dry small sound wood divested of its bark, there is but little smoak. All around the inside of the building, betwixt the second range of pillars and the wall, is a range of cabins or sophas, consisting of two or three steps, one above or behind the other, in theatrical order, where the assembly sit or lean down; these sophas are covered with mats or carpets, very curiously made of thin splints of Ash or Oak, woven or platted together; near the great pillar in the centre the fire is kindled for light, near which the musicians seat themselves, and round about this the performers exhibit their dances and other shows at public festivals, which happen almost every night throughout the year."

We have already noted the statement by Jones that tradition has preserved no memories of the people by whom the Nacoochee mound was erected, and while Bartram lends support to the mysterious origin of mounds occupied by the Cherokee, there is no doubt that the tribe built and occupied various mounds and that Nacoochee was one of them. On this subject, as well as on the reason for the selection of village sites near streams, Mooney¹ comments as follows:

"The Cherokee town-houses were necessarily located in the immediate vicinity of a stream, and where there was about it a level area. The reasons for this were (1) that the dances were held around and about these public houses, frequently beginning inside, and (2) ceremonial bathing formed an important part of the proceedings connected with their sacred dances, such as the green-corn dance and the medicine dance, where the whole body of the performers came out of the town-house to

¹ Cited by Cyrus Thomas, *The Cherokees in Pre-Columbian Times*, pp. 63-64, New York, 1890.

the water, and, after certain ablutions, returned thereto. It was necessary, therefore, that the building be near a stream. As the level areas in their narrow mountain valleys are often overflowed, it is quite probable that in order to place these sacred houses above the floods, they were, as stated in tradition, located on artificial mounds. Moreover, the town-house was the depository of numerous ceremonial objects which could not readily be removed in a sudden emergency. And, as it is said traditionally that a sacred fire was kept burning on a peculiar excavation in the center of the earthen floor, this could not be removed from the hearth-place, and hence some provision for its protection was necessary."

STONE CISTS AND RELATED GRAVES IN THE LOWER LEVELS

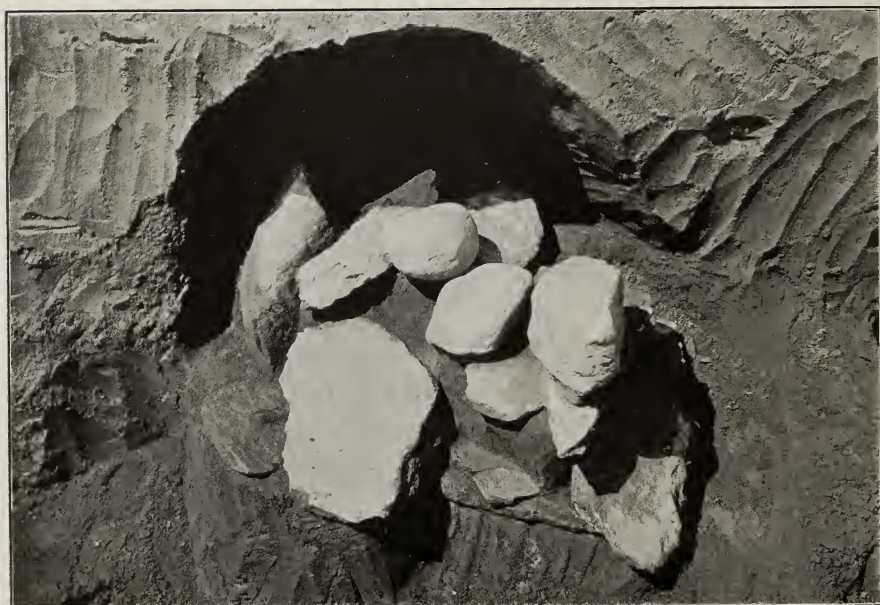
The first record of excavation of the Nacoochee mound is found in Jones's work,¹ from which we quote as follows:

"In June, 1870, Capt. J. H. Nichols, while ploughing in the vicinity of this tumulus, discovered, several inches below the surface of the field, a number of large stone slabs. They were lying at a remove of about thirty feet from the western slope of the mound. . . . During the progress of the investigation, he unearthed three stone graves, quite near each other, but not disposed in a uniform direction. These graves were parallelogrammic in shape, being seven feet long, three feet wide, and a little more than two feet and a half deep. They were all filled with earth, and the surface of the field above them was somewhat elevated beyond the level of the surrounding valley. The sides consisted of rough slabs of slate, between two and three feet long, and about two feet wide, set up on end. The bottom of the central grave was paved with oval boulders which had evidently been obtained from the bed of the Chattahoochee. But one of the three—and that the central grave—was covered. For the covering, or lid, flat slabs of stone rather more than three feet in length had been employed; so that when they rested upon the upright sides and ends of the grave, the enclosure of this vault or rude sarcophagus was complete.

"In this central grave a male skeleton, measuring more than six feet, lay extended at full length. Each of the other two graves contained the bones of more than one skeleton lying in disorder, and carelessly piled in without any regard to regularity. It was obvious that these bones were in a detached condition when they were placed in these

¹ *Op. cit.*, pp. 214-215, 223-224.

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STONE GRAVE (BURIAL 53)

enclosures. It seemed impossible from them to construct distinct and complete skeletons. When removed from the graves and exposed to the air, most of them crumbled. Further investigation will probably develop the existence of other stone graves of similar construction in this vicinity."

Jones then refers to the occurrence of stone graves in Tennessee, Missouri, and Illinois, adding: "It is perhaps not unlikely that the Chaouanons [Shawnee] constructed many of these Tennessee graves, and, crossing the mountains which intervened, peopled Nacoochee valley and other portions of Georgia."¹ He continues:

"An examination of the stone graves of Nacoochee valley inclines us to the belief that to the prevalence of some such custom as this [reserving corpses for a general inhumation and then stripping them of the flesh for ultimate reburial] are the two graves indebted for the remains of several dead enclosed within them. The lack of order in the disposition of the bones, and the careless commingling of various portions of several skeletons, are evident, while in the central grave the corpse was carefully laid at full length upon the stone flooring. As we proceed, we will perceive additional reasons for conjecturing that this grave formed the receptacle of some chief or warrior of note. He was a man of great stature. The few teeth remaining in the lower jaw were much worn, and the alveolar processes had been greatly absorbed. Unfortunately, the skull was in such a decayed condition that it could not be preserved. . . .

"As we have remarked, each of these graves contained human remains. In the central grave was the skeleton of an old man more than six feet high. This corpse had been carefully deposited upon the floor of the vault, at full length, the arms lying parallel with the body. In the other two graves the bones had been disposed without any regard to regularity. Portions of several skeletons were found in each, and it was evident that they had been inhumed in utter disregard of every thing savoring of order. None of these graves had been disturbed previous to this examination. Although located in a cleared field, which had been cultivated for a number of years, the ploughshare had never before touched the stone covering which sheltered them."

¹ For the distribution of stone graves in the Southern states and for numerous descriptions and illustrations of such remains in Tennessee, see Moore, *Aboriginal Sites on Tennessee River*, *Jour. Acad. Nat. Sci. Phila.*, vol. xvi, 1915.

Jones then describes in detail the objects found with the skeleton in the central grave,¹ namely,

1. An implement of pure copper (nearly 10 in. long, $2\frac{3}{4}$ in. wide at the cutting edge and 2 in. wide at the helve, with an almost uniform thickness of a little less than a tenth of an inch, and a weight of $9\frac{3}{4}$ oz.) which lay near the shoulder, and beneath it a piece of matting, consisting of thin layers of split cane about a quarter of an inch wide, interwoven at right angles, "probably the remnant of the sheath or basket which enclosed it." Doubtless this cane was *Arundinaria macrosperma* Mx., which grows abundantly along the banks of the Chattahoochee near by. The fragment found showed traces of dyeing, some of the splints being black, others yellow. An inch and a quarter from the upper end of the copper blade, and extending diagonally across it, was a smooth worn space on each side, about $1\frac{1}{4}$ in. wide, "showing where and how this axe was inserted in its handle. . . . That it had been used is evident both by the abrasion caused by the handle, and also by the fact that the cutting edge is somewhat split and broken." But Jones says the axe is so thin that "it seems scarcely probable that it could have been applied to any general practical uses," although he dwells especially on the abrasion of the copper at the point of contact with the former handle and the splitting and breakage of the cutting edge, which could hardly have been possible if the implement were used only "as a badge of distinction and treasured as a valuable ornament or possession, and not employed as a weapon of war or used for incisive purposes." The surface of the axe "is considerably oxidated, except where it was surrounded by the handle, which would indicate not only that it was attached to the handle at the time of its inhumation, but also that the handle must have consisted of some hard substance. . . . The handle had worn that portion of the axe which it enclosed quite smooth; and this fact, while evincing no inconsiderable use, tended to render such part least liable to decomposition or oxidation. No trace of the handle remained in the grave." It may be said, however, that although there may have been some abrasion at the

¹ Jones, op. cit., pp. 225-238.

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STONE CELT, ARROWPOINTS, SHELL BEADS, ETC., WITH BURIAL 53

point referred to, the entire celt may have been equally smooth at the time of its burial. In the opinion of Jones (p. 231), "the metal of which the Nacoochee axe is formed was obtained from the shores of Lake Superior, and that probably the implement itself was there made." In this connection we may mention the fact that the Spaniards of De Soto's expedition saw copper axes in use among the Georgia Indians in the sixteenth century.

2. Two specimens of *Cassis flammea*, one of them from the central grave, measuring nearly 10 in. in length and about 7 in. in diameter, from each of which the interior whorls and columellæ had been removed to adapt them for use as drinking-cups or some other form of receptacle. "These conchs," says Jones, "were brought from the Southern Atlantic coast, or from the shores of the Gulf of Mexico."

3. Four small copper rods, which Jones conjectured "may be the spindles alluded to by the historians of De Soto's expedition, with which, when heated, the natives were wont to perforate pearls so that they could be strung and worn as beads."

4. A pin-shaped soapstone ornament, carefully polished, a little less than 2 in. long, with the head rather more than half an inch in diameter. (See pp. 71, 85.)

5. Several shell pins, one of which, about $1\frac{3}{4}$ in. long, is like a large-headed wrought nail, somewhat similar in form, although shorter and more pointed, to the soapstone ornament mentioned. The other shell pin is rather irregular in shape, with both ends pointed. The pins with heads, Jones says, were made from the columellæ of some big univalve, such as *Strombus gigas*. (See p. 93.)

6. A flat perforated stone, with a beveled aperture, size not given, but perhaps not exceeding an inch in diameter, which Jones believed was suspended as an ornament.

7. An imperforate discoidal stone.

8. A grooved axe badly worn. (See p. 84.)

9. A beautifully polished wedge-shaped axe or celt of stone.

10. A chisel of greenstone.

11. A fragment of a soapstone pipe.

12. A large stone bead.

These complete the list of specimens taken from the graves beyond the western base of the mound, but in the vicinity were plowed up fifty-five Venetian beads, varying in shape and color, and in addition Captain Nichols found a plain, thin-walled, black slate pipe with the bowl and the stem at a slightly obtuse angle (pl. I, *b*), an earthenware pipe of bird effigy form, and a paint mortar of brown jasper. "No trace of iron, bronze, or steel existed in these graves," says Jones (p. 237). "The presence of the copper axe and stone implements furnishes good ground for believing that their owner had enjoyed no opportunity for exchanging his rude weapons and ornaments for the more serviceable tools which, at an early period, were freely offered by the colonists. This fact, and the total absence of the old Venetian beads found in the neighborhood, and undoubtedly once the property of the Indians, enable us, with considerable confidence, to assign to these graves an antiquity of not less than three hundred and thirty years.¹ Probably they are much older."

So much for the objects found at the Nacoochee site forty-five years before the excavations conducted in 1915. We have dwelt at length on Jones's observations for the reason that they relate to artifacts associated with the earliest period of the occupancy of the site, as well as to graves and their accompanying objects similar to those uncovered during the progress of our own work and at the same level, although at the opposite side of the mound.

We may preface the description of the circumstances attending the finding of the stone graves and their contents at the eastern base of the earthwork by explaining that the excavation of the Nacoochee mound was commenced at the summit by the removal of a stratum of the soil four feet deep, excepting the middle part occupied by the summer-house (pl. II, *b*). This finished, a second stratum of four feet was removed, and so on until, at the eastern side, it was possible to reach the very base of the tumulus without danger to the workmen by caving of the bank. At the same side,

¹ The author here evidently had in mind the occupancy of Nacoochee at the time of De Soto in 1540.

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SECTION OF THE REMAINS OF THE GREAT FIRE-PIT NEAR THE MIDDLE OF THE SUMMIT

10 ft. 6 in. below the summit level, was exposed the top of the first stone-box grave, 5 ft. 10 in. in maximum length, 3 ft. in maximum width, 22 in. in height, and bearing N.E.—S.W. (pl. III). This sepulcher (Burial 34) contained the greatly decomposed remains of the skeleton of an adult, headed N.E., extended on the left side. The grave was partly filled with earth which had sifted in owing to pressure that had forced the grave stones forming the western side inward and those of the eastern side outward, causing the covering slabs to fall partly into the enclosure. That this grave had been constructed long before the mound acquired its maximum height is certain, as the strata immediately above the western side of the grave was undisturbed, showing that the cist had been placed only slightly beneath the surface at the time it was built. The bottom of the grave was floored with slabs of stone. Under and projecting rearward from the neck of the skeleton was a completely flattened shell, apparently part of a conch, of the consistency of lime, within which was a piece of micaceous schist; and in the same condition were two small univalve shell beads found about the position of the right ear. No other artifacts were found in this grave.

About four feet east of this grave, but at a depth of 17 ft. 5 in. from the summit of the mound to the bottom of the grave, and 14 ft. 9 in. beneath the slope (*i. e.*, about 5 ft. deeper than Burial 34), was another stone-box grave (Burial 39), measuring only 4 ft. 7 in. by 3 ft. 10 in., by 2 ft. 6 in. in maximum height (pl. IV). The inside measurement of this grave was 3 ft. 10 in. long by 2 ft. 5 in. wide. In some respects this interment was the most interesting of the many uncovered at Nacoochee, by reason of the finding, among other objects, of an earthenware effigy vessel of painted ware, the only specimen of painted pottery, with the exception of a small sherd recovered from the same section of the mound and at approximately the same depth, found during the entire exploration. The body had been laid on its right side, with the head directed eastwardly, on a layer of bark placed on the earthen floor. The bones of the trunk had almost disappeared through decay, but were sufficiently traceable to indicate that the body had been bowed

greatly outward, while the upper leg-bones, which were in somewhat better condition, were flexed strongly upward and the lower leg-bones lay against the pelvis. This distortion was evidently necessary because of the small size of the grave. The skull, which was of the consistency of cornmeal owing to decay and the ravages of insects, lay in the upper left-hand or northwest corner of the cist.

When the top of this grave was encountered, it was found necessary to remove a large mass of superposed soil before it could be examined, and this was of such quantity as to require an entire day's work. Covered with earth for protection over night, some boys visited the spot and in their play jumped on the grave from the bank above, displacing the stones covering the top and breaking into pieces the effigy vase to which reference has been made. This vessel, which was found seven inches east of the left clavicle, hence at the rear of the body, is of porous, shell-tempered ware, *écru* in color, on which has been applied a whitish slip, ornamented in brown with four connecting triangles at the rim, three continuous bands on the neck, immediately beneath which, surrounding the upper part of the body, is a series of connected spirals, separated below by a field of brown from a band of concentric circles interspersed with horizontal bars, followed by another area of brown above the legs. The vessel, which probably contained water when deposited in the grave, has been repaired (pl. v), and measures $9\frac{3}{8}$ in. in height by about $6\frac{1}{2}$ in. in diameter exclusive of the appendages. The head, which projects midway of the globular body, is round, with short flattish ears; the eyes are indicated by almost indiscernible knobs surrounded with painted bands; the nose is rather prominent, being accentuated by a depression at each side, but is not well defined between its tip and the mouth; the mouth is a shallow, horizontal slit three-quarters of an inch long, and recedes in such manner as to make the animal chinless; the neck is stout, with an almost goiter-like swelling in front and banded with vertical brown lines. Painted diagonal lines of brown extend from the ears to between the eyes, where they meet the brown area that accentuates the nose. The tail, which was made with a roll of clay one end of which was inserted in an aperture pierced in the

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SECTIONS SHOWING STRATIFICATION OF THE EASTERN PART OF THE MOUND

body before firing and then spread inside by pressure while still plastic, curves upward, but protruding from just beneath the tail is another appendage, of somewhat lesser diameter, which curls upward and then over and under the tail, meeting itself about three-quarters of an inch beyond the point of beginning, as if to give the impression of a knot. The tail also has been painted brown, but the pigment is so worn as to have the appearance of mere daubs. The legs of the quadruped are stubby, being only about an inch long, and merge into the body; they were painted with brown stripes, much of which has worn away. What animal the maker sought to represent is not known. The tail suggests an opossum and the head a wildcat.

A vessel almost identical in form and design, but a couple of inches shorter from head to tail, was found in 1890 in a stone grave on the Bosley farm about four miles west of Nashville, Tenn.¹ So close is the resemblance of the two vases as to lead to the conclusion that they were derived from the same people and that the one found at Nacoochee was intrusive. This Tennessee vessel is here reproduced (pl. vi) through the courtesy of Prof. L. C. Glenn of the Department of Geology of Vanderbilt University, Nashville, Tenn., in which institution this interesting receptacle may now be seen. Another effigy vessel of the same type, from near Lebanon, Tenn., and now in the Peabody Museum of Harvard University, is about eight inches long and of the same height.²

Against the shoulder of the effigy vase found by us was a well-preserved conch, from which the columella had been removed evidently for the purpose of transforming the shell into a cup and which was slightly broken from the same cause that resulted in the breakage of the effigy vessel. About the neck of the skeleton

¹ G. P. Thruston, *Antiquities of Tennessee*, pp. 152-153, Cincinnati, 1890. Ramsay (*Annals of Tennessee*, pp. 78-79, Philadelphia, 1853) says: "The late General Robertson learned from the Indians that more than a century and a half ago, (1665,) the Shawnees occupied the country from the Tennessee river to where Nashville now is, and north of the Cumberland, and that about 1700, they left this country and emigrated north." And again, "In 1714 Monsieur Charleville opened a store where Nashville now is, occupying as a dwelling a fort which the Shawnee had built there."

² Eleventh Annual Report of the Peabody Museum, p. 359, fig. 55, Cambridge, 1878.

were found seven drilled pearls, still retaining some of their nacre. In the soil beneath the skeleton were several small unrelated potsherds and three small rude stone discs which probably had no direct relation to the burial; and the same may be said, no doubt, of a broken ear-plug of pottery found beneath the pelvis. Beneath the feet were three imperfect hammerstones. Outside the grave, six inches from its northwest corner, was an unfinished discoidal stone, similar to many found throughout the progress of the excavation.

Another noteworthy burial (No. 46), evidently that of an adult, was found only a few feet southeast of Burial 39 and at about the same level, namely, 14 ft. 6 in. below the slope of the mound, with the head probably directed southwestward. So wet was the ground in which this grave was encountered that when it was partially uncovered it was necessary to bail away the water that rose to the surface. As in many other instances at Nacoochee, this skeleton was in such an advanced state of decay that it was not possible to follow its course with exactness or even to determine the form of the bones with the exception of the femora, which showed a slightly curved surface, the others having been completely flattened by pressure and become virtually a part of the bark lining of the grave. It was from the position of the femora and the shape of a certain area discolored by decayed vegetal matter that the direction of the skull was conjectured, although the traceable bones covered a space of only 22 inches in length.

The first indication of the presence of this grave, which was not encased in a stone cist, was given by the upturning of a fragment of bark at a point very near water-level, at what proved to be the middle of a layer of this material covering a space of 9 by 15 in., surrounding which, as well as the remains of the skeleton, was the area of black, decomposed vegetal matter, probably also bark, irregular in shape but measuring 3 ft. 7 in. by 3 ft. 2 in. maximum. On lifting the preserved bark covering, there was found adhering to the under part a fragment of coarse fabric (fig. 2), and beneath this a piece of matting (pl. VII). Between the matting and the fabric were fragments of thin sheet-copper, the salts of which

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A. STONE DEPOSIT ADJACENT TO BURIAL 6



B. STONE DEPOSIT ASSOCIATED WITH BURIAL 9

had preserved the textiles. This copper ornament was found to be in the shape of the torso and arm of a human figure, but unfortunately it was so disintegrated as to be beyond recovery, except in small pieces. Embedded in the under-surface of the bark covering,

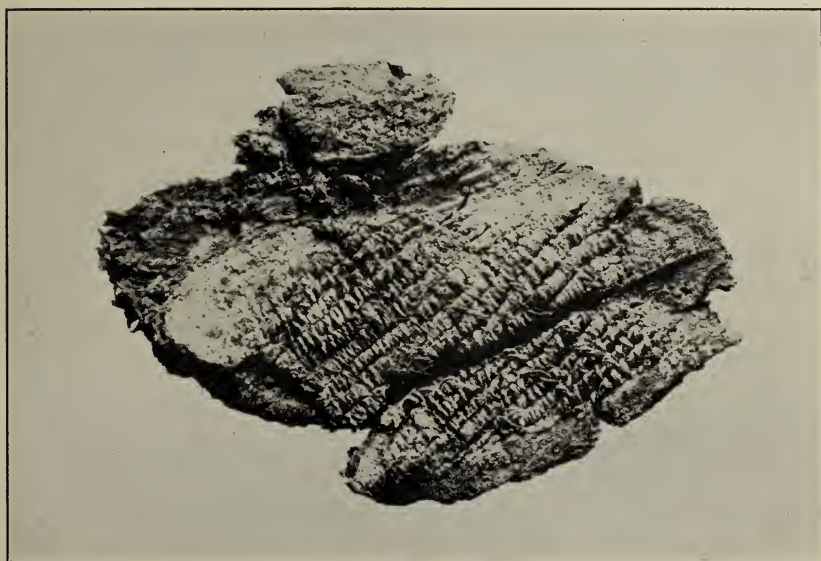


FIG. 2.—Detail of matting with Burial 46.

a few inches west of the matting, was a copper celt,¹ with a part of the wooden handle still in place (pl. VIII); this likewise had rested on the matting. Beneath the celt, other very thin pieces of a sheet-copper ornament were found, including one representing the claw of a bird, but these also crumbled on exposure. The matting on which the celt rested plainly showed the impression of the implement and its wooden handle, and it was possible to preserve the entire mass. So far as could be determined, the celt and the sheet-copper ornaments had been deposited with the matting and the fabric about the position of the pelvis.

It will be observed that the method of depositing this celt on

¹ As employed in this paper the term "celt" must be understood as applying to that class of ungrooved implements, whether of copper or of stone, that had been hafted for use in the manner of axes or hatchets. See pages 82-84.

the matting in the grave is generally similar to that of the copper implement placed in the stone grave unearthed in 1870 by Captain Nichols near the western limit of the mound, as previously described. The celts themselves, however, differ somewhat in form as well as in size, the Nichols implement (the whereabouts of which is now unknown) being almost a third longer (nearly 10 in. in length) than the specimen found by us, which is $7\frac{1}{4}$ in. long, by 1 in. wide at the poll and $1\frac{1}{2}$ in. near the cutting edge. Moreover, the Nichols celt is flaring at the blade-end and squarish at the other, whereas the celt in the Museum of the American Indian, Heye Foundation, tapers gradually and regularly from end to end and is slightly rounded at the poll. Again, the Nichols celt is less than one-tenth of an inch in thickness throughout, while the other averages about three-sixteenths of an inch. A feature in common, however, is the angle at which the two celts were hafted—each in such manner that the under angle formed by the insertion of the blade in the handle (when viewed as shown in pl. VIII) is slightly acute. Of course, in the case of the Nichols implement, one can judge only by the impression left by the handle on the blade. Interesting in this connection is the fact that two of the stone celts (p. 83) found by us in the mound show that they had been hafted in the same manner and at relatively the same angle. There is no evidence of lashing on the handle of the copper celt found by us, the two narrow bands crossing the blade being splints from the matting. The recoverable portion of the wooden handle of the celt is well preserved, thanks to its contact with the copper of the celt and the sheet-copper ornaments. While the original length of the handle is unknown, it evidently was quite short in comparison with the length of its blade, if we may judge by the taper of the remaining portion.¹

The matting found in association with the celt is of diagonal plaiting which forms a pattern in parallel rows. The first strand of each group of four passes under the fourth transverse strand met by it, the second of the group passes under the fifth, the next

¹ A similar celt is mentioned and illustrated by Moore, *Certain Aboriginal Remains of the Black Warrior River*, *Jour. Acad. Nat. Sci. Phila.*, vol. XIII, 1905, p. 154, fig. 27.

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A. BURIAL 2 WITH ITS ACCOMPANIMENTS



B. BURIAL 3, SHOWING COPPER ARM-BANDS

the sixth, and so on, but always preserving the under-four over-four order. The strands or splints, which average an eighth of an inch in width, were probably rather loosely plaited, and are of tough fibrous material like split cane. Adair's description of the Cherokee baskets is generally applicable to the matting found by us. He says: "They divide large swamp-canes into long, thin, narrow splinters, which they dye of several colours, and manage the workmanship so well, that both the inside and the outside are covered with pleasing figures."¹

There is no indication that the specimens of matting found by us were ever colored, in which respect they differ from the basketry found by Captain Nichols and described by Jones. Another point of difference in the textile found in the two parts of the mound is the technique, the Nichols specimen² showing a rectangular, irregular plaiting so far as it is possible to determine from such a small example.

The fragment of textile found with Burial 46, shown in fig. 2, has been examined by Miss Mary Lois Kissell, who pronounces it to consist of a binding element of twisted two-ply fiber on a foundation also of twisted but different fiber. The binding element is wrapped around the foundation in coils, the segments thereof being stitched at intervals of about half an inch. The fabric has been so coated with copper salts that its true character is determined only with difficulty, nor can we hazard a reasonable conjecture as to the use to which it was put, unless it served as a bag. No indication of coloring is traceable.

Another stone grave (Burial 53) was encountered in the eastern portion of the mound, at a depth of 16 feet (pl. ix). The skeleton, which lay flexed on the right side, was directed N.E.—S.W., the skull toward the N.E. The body had been covered with earth, on which seven large flat stones were placed, and on these the boulders, the whole being covered with bark. Only one of the flat stones was on edge when the grave was uncovered. The skeleton had been laid on bark, which had almost completely decayed. Resting in the

¹ James Adair, *History of the American Indians*, p. 424, London, 1775.

² Jones, *op. cit.*, p. 225, pl. vi, 1.

bend of the left arm was a stone celt, which lay parallel with the axis of the body, the cutting end toward the feet. On the poll of the celt were 10 small arrowpoints, and at the side a number of large shell beads and the wooden core of an ear-ornament (pl. x and fig. 63). Beneath this celt and its accompanying objects were another celt and 35 more arrowpoints, the second celt lying immediately beneath the other and pointing in the same direction. As in the case of the others, these arrowpoints rested on the blunt end of the celt which they accompanied. Over this deposit of celts, arrowpoints, and shell beads, was a hard black incrustation which formed a shell-like pocket in which the objects lay. Northeast of this deposit, and almost touching it, was another small depression, similar in material, coated with a layer of greatly decayed shell or bone. In the center of this pocket were a number of lobe-like elevations, covered with white material similar to the decayed bone or shell described. Still another pocket was found northeast of and almost touching the skull; in it was a fragment of a shell bracelet. Projecting from beneath the skull were a large stone celt and a smaller one (pl. LVI, *d*, *e*), the latter perforated at the narrower end.

Under one of the stones covering the grave, pieces of the shells of hickory-nuts, chestnuts, and squash seeds were found; and just above one of the grave-stones was a large arrowpoint.

No other burials in stone-box graves were found in the mound, the deposits of stones in association with burials nearer the summit not being regarded as such. These will be described later.

The occurrence of these graves and their contents, not to mention others, on both the eastern and western bases is evidence of the unity of culture of the inhabitants of Nacoochee long before the mound had reached its ultimate height, for, as will be shown later, the earthwork was no doubt in process of erection during a long period. The presence of such mortuary objects as copper celts, matting, a sheet-copper ornament, etc.,—objects not found in the upper portions of the mound where conditions for their preservation were more favorable—indicate more or less of a change in the culture of its inhabitants, due possibly to the influence of civilization.

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A. BURIAL 4 WITH ITS ACCOMPANIMENTS



B. GRAVE 47, AN EXAMPLE OF A GREATLY FLEXED BURIAL

We will now characterize the features pertaining to the construction of the mound as exhibited by the excavation, especially of the eastern side (in which section the work was particularly concentrated), leaving the other graves for consideration later.

FIRE-PITS

It has already been shown that about two feet of the summit of the mound had been removed in recent years. Human bones are said to have been found in the process of removal, but of their character nothing is now known, and of course the conditions incident to the summit itself are no longer possible to determine.

In removing the uppermost four feet of the mound as it existed when the work was commenced by us, we discovered the remains of an extensive fire-pit, the top of which reached to within six or seven inches of the surface of the mound, north of its center. This pit, shown in plate XI, aggregated 8 ft. 9 in. in diameter. Careful observation of the pit showed that it actually consisted of a series of smaller pits, more or less fused, that had been used successively; then as the earth of the mound had been renewed from time to time and the fire-pit then in use had been covered with earth, another was formed above. This earth covering of the successive pits had burned red, as was always the case when fire had come in contact with the black soil of the mound, as before described. At a depth of 4 ft. 3 in. beneath the surface, directly under the fire-pit, was a thin layer of charcoal, and four inches below this was another, each extending a foot beyond the limit of the fire-pit at the south and seven feet beyond it at the north, as if the remains of a shelter, or of two shelters, that had been erected on the summit of the mound at the time it had reached only to that height. These thin charcoal strata are faintly visible at the very bottom of the vertical wall in which a section of the fire-pits is shown. Immediately above them, showing in the illustration as a thick, dark stratum below the lighter material of the fire-pits themselves, were several ill-defined strata of bright-red clay. The fire-pits themselves were completely filled with gray wood-ash, so indurated as to be almost of the consistency of cement concrete, containing small

pieces of charcoal and stone, and a few potsherds, including the crested head of a bird that evidently had formed part of a smoking pipe, as well as a pipe of steatite. Near the southern border of the fire-pits was a post-hole, dug in recent times through the hardened ash.

We have already noted that, according to Cherokee tradition, a sacred fire was kept burning on a peculiar hearth excavated in the center of the earthen floor of the town-house, which was built on a mound. It would seem that the great fire-pit near the middle of the summit of Nacoochee represented the remains of one of these sacred places.

Throughout the mound, at varying depths, were numerous other evidences of fires, in some cases very small, in others occupying from one to two cubic feet or more, and in every instance filled with gray ash and wholly or partly surrounded with reddened earth. These fire-pits were significant in that by far most, if not all, of them had been made in the surface of the mound as it existed at the time, showing that the mound had been formed by gradual accretion.

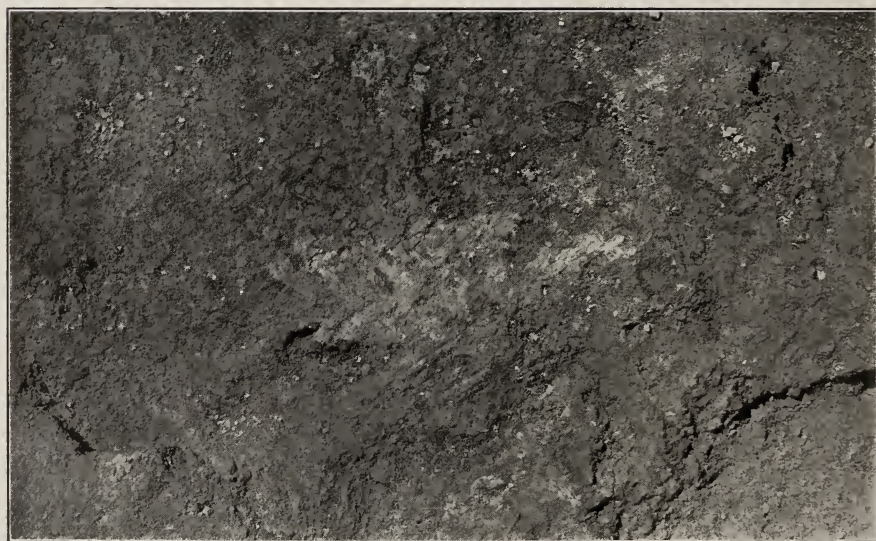
A few feet northwest of the large fire-pit, covering an area approximately 8 ft. square, were the charcoal remains of a layer of reeds lying rather regularly in an east-west direction, with burned poles, about $2\frac{1}{2}$ in. in diameter, extending in the same direction as well as transversely. Over parts of the charred mass, which was 2 to 3 in. in thickness, was a layer of red-burned earth of about the same thickness as the charcoal, and under other parts was a similar layer, the whole evidently being the remains of a shelter of pole-and-cane construction.

Another fire-pit, in the southwestern section of the mound, was found 4 ft. 2 in. below the summit; it was 22 in. in circumference at the top, but tapered to about 10 in. at the base, and was 2 ft. in depth. The top of this fire-pit, judging from the surrounding soil, seemed to have been at the level of the summit of the mound at the time the pit was in use. The pit was entirely filled with a mixture of red-burned earth and charcoal. From its top downward, on both sides, extended a stratum of gray, sandy clay, as if from

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A. BURIAL 48



B. TRACES OF MATTING COVERING BURIAL 50

the river-bed, for a distance of five feet, or about twelve feet in all. Beneath and around the pit were seven stones, mostly flat, some roundish, ranging in weight from 15 to 40 pounds. No sign of bone or of artifacts was in or near the pit. In this part of the mound there was great paucity of sherds or other refuse.

In addition to a fire-pit found in association with Burial 10 (see p. 41), there was another, 5 ft. 8 in. northwest thereof, measuring about 13 in. in depth by 8 in. in maximum diameter, the top being 19 in. below the mound surface. Spreading from the top of the pit in all directions was a stratum of red-burned earth mingled with ash, two to three feet in thickness. This stratum evidently marked the surface of the mound at the time the fire-pit was in use.

Still another fire-pit was uncovered in the adjacent field, southeast of the mound proper. This pit was 7 in. beneath the surface and was 3 ft. deep. It extended in a N.E.-S.W. direction, was $2\frac{1}{2}$ ft. long, 20 in. wide at one end and 12 in. at the other, and was almost filled with stones, none larger than eight inches in greatest dimension, mostly flattish, and all showing the effect of fire. Beneath the stones was charcoal, and scattered through the earth adjacent to the stones were numerous potsherds and flecks of charcoal. Also beneath the stones was a bone of pasty consistency measuring 1 by 10 in., so decayed as to be beyond identification.

At the eastern base of the mound another fire-pit was unearthed, with three flat stones on top and charcoal and red-burned earth beneath. Both in and under this deposit were many fragments of incised and plain earthenware, some quite large. Some of the charcoal found preserved the shape of poles or small logs, $2\frac{1}{2}$ to 3 in. in diameter and 2 to 3 ft. long. The extent of this fire-place was 6 ft. in length by 15 in. in thickness. The bottom was 20 in. above the base of the mound, as indicated by the undisturbed brownish clay floor. It is not improbable that this place, as well as the one last mentioned, was used for firing pottery. Beneath the fire-place, one foot above the mound base, was a stratum of reddened earth and fine charcoal mixed, in thickness from 8 to 10 in.

A fire-place 12 by 16 in. was discovered in the northeastern side of the mound, 6 ft. 10 in. below the surface. This consisted

of three flat stones, one still on edge, between them being a mass of charcoal; beneath was a layer of yellow clay, the position of which showed that the fire-place and the superposed earth had settled about six inches from its original position. This fire-place was about six feet south of the point where Burial 70 presumably lay. Extending from a point just beneath the fire-place southward for a distance of three feet was a stratum of charcoal mixed with animal bones and potsherds.

STRATIGRAPHY OF THE MOUND

The evidence afforded by the fire-pits was not the only indication of the gradual building of the mound and of its occupancy at different levels during the process, for throughout the excavation the face of the trenches gave ample testimony that such was the case, the periodical building-up and widening of the earthwork being easily read from the stratification of the successive accretions. Especially was this determinable as the depth of the excavation of the eastern side increased until it reached the original base, 19 ft. below the summit, or nearly 2 ft. lower than the surrounding field.

A typical section exposed 12 ft. east of the eastern rim of the summit and 12 ft. in depth showed the following character:

Commencing at the bottom, above an undisturbed sand layer¹ which contained no charcoal, was stiff, moist, clayey earth, very compact, for a thickness of 22 in., mingled with small fragments of what appeared to be iron-stained clay. Next above was a layer of red-burned earth, 18 in. in length and 3 in. thick at its widest or central part. Above this for an irregular few inches the clayey earth was darker in color. Next, for a thickness of six feet, was a similar deposit of thick, clayey earth, in which were many specks of charcoal; the top of this stratum was eight feet above the sandy base of the mound, and its upper two feet was particularly rich in charcoal, with here and there a particle of red-burned clay or earth. The next four feet consisted of darker soil like that of

¹ It should be remembered that the entire field surrounding the mound has been covered by the overflow of the river even within recent years. It is said that the precipitation in this section of northeastern Georgia is as great as that of any part of the United States.

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a



b



c

EARTHENWARE JARS FROM NACOOCHEE (RESTORED)

the field, with a fleck of charcoal and bone appearing at intervals. The stratification was not well defined, but was sufficiently plain to show that the dip was toward the outer base of the mound, and seemed to indicate here, as in the face of other trenches where similar observations were made, that the mound had been built at intervals.

Throughout the exposed face of the deep trench in the eastern side, small fragments of earthenware were found, all belonging to the three principal styles of Nacoochee pottery to be described later. No one of these was confined to any particular level or depth, indicating that the stamped ware with straight-line, rectangular, or curvilinear patterns, as well as the incised ware, was synchronous in manufacture. The same may be said of the quantities of sherds found beneath all the slopes of the mound from top to base.

Later in the work, when the excavation had entered the eastern side until its face had reached a depth of 17 ft. 2 in., Mr Pepper observed what had evidently been a smaller mound within the great one. This measured 27 ft. 9 in. in length and 5 ft. 3 in. above a stratum of yellow clay and sand under which burials were found, and which, as nearly as could be determined, had been laid down on the original surface of the ground.

This lesser mound was composed of black soil and yellow sand, so intermixed that the section presented a cloudy appearance, strongly contrasting with the dark-brown soil above. The top of this small mound was 11 ft. below the summit of the great structure, the space between being filled with a semistratified mass whose lines dipped away from what had been the summit of the lesser mound. This overlying deposit was so broken with small pockets of sand and other materials that measurements were not practicable, but the lines conformed with the general contour of the small mound for some distance on each side thereof, then broadened until they became almost horizontal.

The yellow clay at the base, above referred to, varied from 5 to 7 in. in thickness and extended northward from the east-west center line for a distance of 13 ft.; northward farther beyond this point the stratum became sand, whose thickness varied from 5 to 8 in., ending 21 ft. beyond the clay. South of the east-west center

line the same yellow stratum continued, becoming thinner as it extended southward until it reached an ultimate length of 20 ft.; hence the basal yellow clay-sand deposit was 54 ft. in total length.

Under and through the clay and sandy base referred to were five pockets, the measurements of which are given in the accompanying

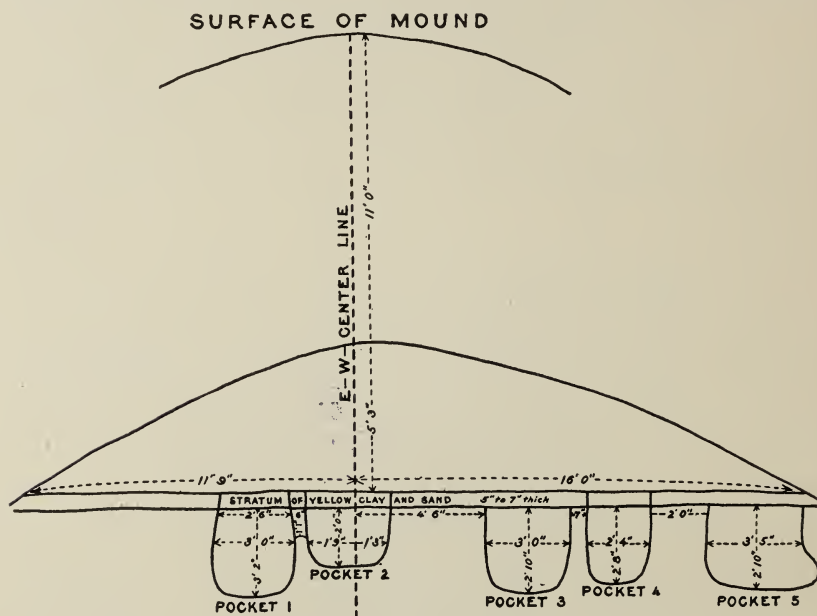


FIG. 3.—Pockets beneath the lesser mound within the larger one.

sectional drawing (fig. 3), and whose character and contents were as follow:

Pocket 1.—This pocket had been cut through the yellow-clay stratum and was crossed by several thin layers of sand. At the bottom were charcoal and burned bones. The center of the deposit was 2 ft. 2 in. s.s.w. from the knee of Burial 54; it was 1 ft. 8 in. in diameter, 2 in. in thickness, and 1 ft. 2 in. below the level of the skeleton. Most of the fragments of bones seem to be non-human, but some of them, notably a piece of skull having the appearance of part of an occiput, may have been human. Owing to the fact that there was a portion of the yellow-clay stratum between pockets 1 and 2, it would seem that these holes had been dug at different

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EARTHENWARE JAR FROM NACOOCHEE (RESTORED)



a



b



c

EARTHENWARE BOWLS FROM NACOOCHEE (A AND C RESTORED)

times; if so, the bone deposit referred to had no association with Burial 54.

Pocket 2.—Cut through the stratum of clay and adjoining No. 1 on the north, was a layer of yellow clay 6 in. wide, between the upper edges of Pockets 1 and 2, but which became joined 13 in. below the stratum. This pocket was not stratified, but it contained charcoal mixed with the earth and sand, as well as the remains of the skeleton of an adult (Burial 54) which had been interred in a N.E.—S.W. direction, headed N.E., with body flexed, as determined by the relative positions of the pelvis, leg-bones, and skull, all in very fragmentary condition. The grave had been lined with bark. This grave was 18 ft. below the summit of the mound.

Pocket 3.—As shown in the sectional sketch, this pocket was covered by the undisturbed clay stratum, and as in the case of Pocket 1, it was stratified with light and dark sand. No objects were found in this pocket, nor any signs of a burial, but owing to the fact that the human remains found in the other pockets had almost disappeared through decomposition, it is possible that there had been a burial in this one also. If the burial of a child, it would have been one of only two found in the lower section of the entire mound.

Pocket 4.—This had been cut through the yellow-clay layer and contained a strong admixture of the yellow clay and earth. Found therein were the greatly decayed remains of a skeleton (Burial 55), probably of an adult, represented only by a discolored area in which were parts of a skull and teeth, the former at the northeastern end of the grave. The burial was without accompaniments and lay 18 ft. beneath the mound summit.

Pocket 5.—The top of this pocket lay beneath the yellow stratum, which here was of clay and sand. The contents consisted in part of a mixture of yellow clay from the stratum, and soil, especially in the southern upper corner, together with sand and earth containing a sprinkling of charcoal. Also found in this pocket, were a leg-bone and part of a pelvis—all that remained, in recognizable form, of the skeleton of an adult (Burial 56). No artifacts accompanied these remains.

Adjoining Pocket 5 and extending six feet north of it, beneath the yellow stratum (which here was wholly of sand), was a discolored area containing charcoal, some yellow clay, and a few small, dissociated pieces of bone, probably animal. This discolored deposit was 2 ft. 10 in. in thickness. In the central part of the area, within a foot of the northern side of Pocket 5, a small stone celt was found. The earth in this deposit exhibited no discoloration such as was usually seen when a burial had been present. South of Pocket 1, beneath the sand stratum which formed the continuation of the yellow-clay layer, the ground was discolored and likewise contained some charcoal.

Another section was carefully noted by Mr Pepper in the north-eastern part of the mound at an average depth of 17 ft. Here the base consisted of a stratum of stones, mostly rough pieces but also some boulders, none very large, extending N.N.E.-S.S.W. for a horizontal distance of 25 ft. 6 in., with a thickness averaging 2 ft. The stones rested on a layer of bark, some of the pieces of which

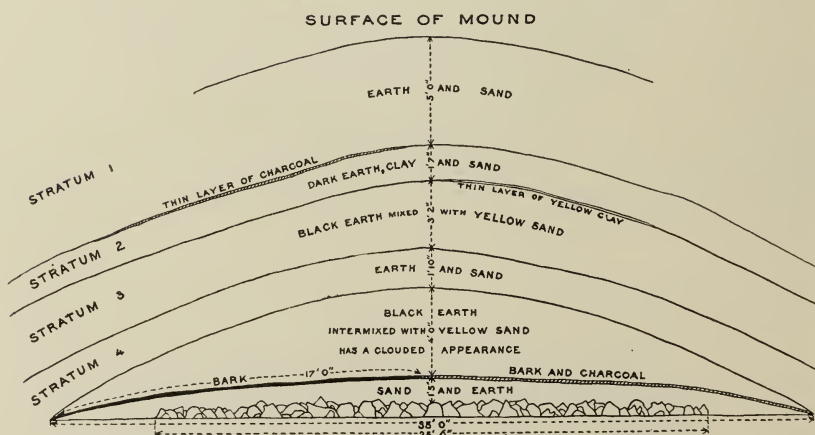


FIG. 4.—Section of the mound in its eastern portion, showing stratification.

were an inch in thickness, which in turn lay on a five-inch stratum of yellow sand, below which was a mixture of sand, clay, and charcoal. This seemed to have been the original level of the ground. (See pl. XII.) At the northern end of and about 18 in. lower than the stone layer, a fragmentary jar with stamped decoration was

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EXAMPLES OF JARS TAPERING TOWARD THE BOTTOM (RESTORED)

found, the largest sherd being 18 ft. below the surface of the mound. This fragment was surrounded by a mass of charcoal and animal bones, as well as portions of other vessels. Directly over the stones was a layer of bark and charcoal, curved in section, the ends of the deposit resting on the end stones and extending about five feet beyond them in each direction, while the central part was a foot above the stones, with earth between. The appearance of the strata above the stone layer was generally similar to that of the exposed section containing the burial pockets previously described; that is, they indicated a small mound whose base rested on the layer of yellow sand. The composition of this lesser mound above the stones and the upper bark deposit was black earth intermixed with yellow sand, giving it a cloudy appearance; it was 4 ft. high, conical in section, the sides tapering rather regularly until they reached the base formed by the upper bark layer, which was 35 ft. in extent. Next above this mound-like deposit was a stratum of sand and earth, 1 ft. 10 in. in thickness at the apex, but broadening toward the bottom. The next stratum above consisted of black earth mixed with yellow sand, 3 ft. 2 in. thick at the apex, with a thin layer of yellow clay extending from the apex down its northeastern slope for about 12½ ft. Next above was a layer of dark earth, clay, and sand, almost level at the center (where it was 1 ft. 7 in. in thickness) and toward the southwest, but still sloping considerably at the northeast. This stratum was marked along the top of its southeastern half by a thin layer of charcoal. Above this, to the summit of the mound, the deposit consisted of earth and sand to a depth of 5 ft. The stratigraphy of this lesser mound and of the subsequent fillings above is shown in the accompanying sketch (fig. 4).

STONE DEPOSITS

Allusion has been made to deposits of stones encountered throughout the excavations, some of which had the appearance of graves.

Perhaps the most significant of these was uncovered a few feet east of the center of the summit and four feet deep. The stones were not arranged in any particular order (pl. XIII, *a*), and they did

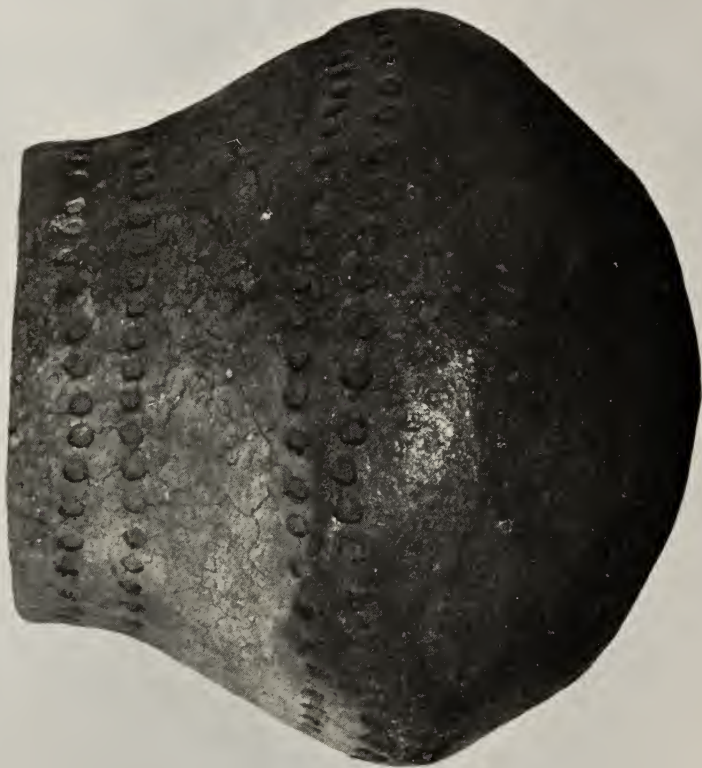
not have the appearance of once having formed a box grave like the cists uncovered at the lower levels of the eastern side of the mound. No human remains were found within the space covered by the stones, but scattered at intervals, especially near the eastern end (the stones had an E.-W. trend) were several fragments of bones, presumably of a deer. Ten inches west of the stones, however, was the skull of an adult (Burial 6), all of whose bones were completely flattened into a pasty mass; yet it was possible to determine that the remains had been placed on the right side, with the head directed eastward and with knees flexed. No artifacts accompanied the burial, and there was no direct evidence that the stone deposit and the burial were related. Above the skull was an eastern pocket of the great fire-pit before described, which at this point was 19 in. in diameter at the top and 18 in. in depth, the bottom extending to within 18 in. of the skull, but evidently the pit had no association with the burial. The pit contained wood ash, particles of charcoal, and small fragments of red-burned earth. Immediately above the mouth of the fire-pit was a clay flooring, two inches in average thickness and extending a couple of inches beyond the rim of the pit at each side.

Two feet north of the skeleton was a mass of red-burned earth intermixed with charcoal, extending throughout which, for a length of 3 ft., was a charred beam or pole, 1 in. to $2\frac{1}{2}$ in. in diameter, over which, separated by a thin layer of red-burned earth, was a mass of charred grass, in places half an inch thick, for the greater part laid longitudinally. It may be conjectured that this burned material represented the remains of a thatched house or shelter that stood on the mound at a time its summit was below the present level.

Generally similar to this stone deposit was another, found 4 ft. 6 in. below the summit, the stones being arranged as shown in plate XIII, *b*. The extreme length of the area covered by the stones, which extended in a N.E.-S.W. direction, was 9 ft. 7 in., and the maximum width 5 ft. Under the upright stone showing in the rear center of the photograph was a rough, flattish stone, disintegrated by fire, on and about which was a mass of charcoal and

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SMALL, CRUDE JAR WITH PUNCTATE DECORATION FOUND WITH BURIAL 10. HEIGHT $5\frac{1}{4}$ INCHES

ashes; and under and about another stone, about the middle of the deposit, were several fragments of a smoke-blackened cooking-pot of incised ware, with a quantity of charcoal under and about them. South of and adjoining the southernmost stone of the deposit was a well-defined flooring of red-burned earth, its upper surface smoke-blackened, covering about one foot square. Indeed, the entire ground covered by the stones had been burned before the stones were placed, as fragments of charcoal and of red-burned earth were mingled with the dark earth beneath the stones. Some of the stones had been fractured as if by heat, and two of them were much crumbled from the same cause. Removal of the stones exposed slight traces of a human burial, including fragments of the crowns of two teeth (Burial 9).

Another deposit of stones, generally similar to the last two described, but not associated with even a trace of skeletal remains, was uncovered in the northeastern part of the mound, 14 ft. 6 in. below the surface. This deposit consisted almost exclusively of slightly water-worn or weathered stones, among which was some charcoal. There was nothing to indicate the object of the deposit.¹

A deposit of stones 13 ft. beneath the surface of the eastern section of the mound was similar to the last except that the stones were larger. The largest and uppermost stone was a boulder that had been fashioned into a mortar; under it was a layer of yellow-clay 8 in. in thickness, on a base of black earth 4 in. thick, both strata increasing in width toward the southeast. Twenty inches south of the boulder-mortar and 18 in. below it was a heavy flat stone, 22 x 14 x 4½ in., in a slanting position. East of the stone last mentioned was a heavy deposit of large pieces of charcoal, while surrounding the stones and scattered through the dark layer beneath the clay were animal bones, some of which were calcined or smoke-blackened, mixed with which were potsherds and an arrowpoint. From his observation at this point, Mr Pepper concluded that house refuse had been thrown here at a time when it

¹ Merely for convenience of record this stone deposit was tentatively noted in the field as Grave 11.

was the slope of the mound. It was noted that the strata of material composing the mound here trended southward.

A stone deposit was found in the southwestern side of the mound, at a depth of 10 ft. This consisted of a boulder of irregular form, $13\frac{1}{2} \times 6\frac{1}{2} \times 5$ in., and, 22 in. southwest of it, a fragment of a flat stone, $11 \times 8\frac{1}{2}$ in., with broken edges. Just west of the boulder, $3\frac{1}{2}$ in., commenced a formless mass of animal bone measuring $9 \times 4\frac{1}{2}$ in., by $4\frac{1}{2}$ in. thick, but irregular in shape and with a hard coating such as has been already noted in connection with other decayed bone at Nacoochee. Fifteen inches southwest of this mass was another, smaller but of similar composition. Small pieces of bone mixed with charcoal were scattered through the deposit.

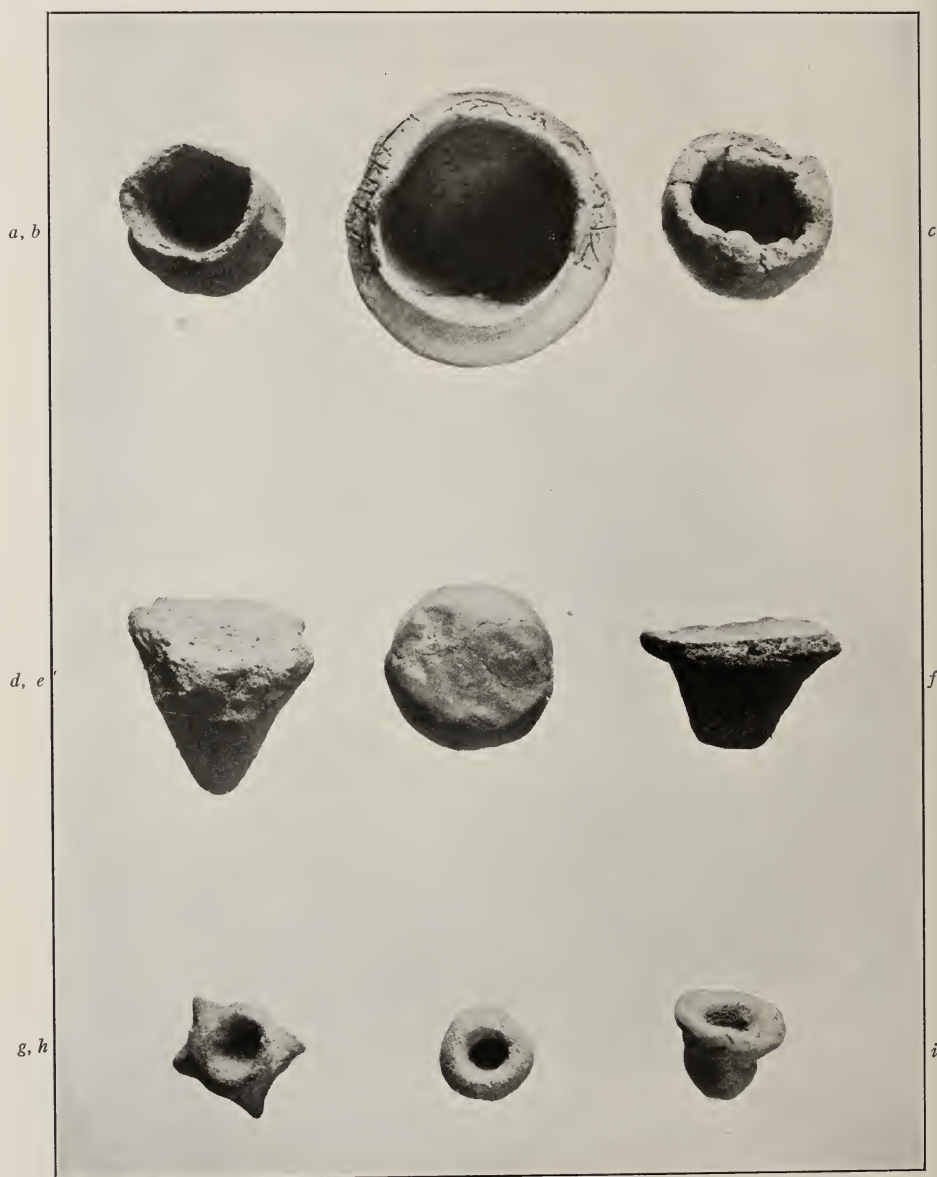
Five inches north of the northern end of the stone stratum near the base, referred to on page 34, and two feet above it, were four stones, three water-worn, the other irregular in shape, all laid horizontally. These were deposited outside the dark "small-mound" area described, but just above it. Nothing was found with them, and there seemed to have been no connection between these stones and the stone stratum at the base. In the southeastern section of the mound, 16 ft. in depth, was a large grooved stone, standing on end, with only charcoal in association.

BONE DEPOSITS

A mass of bone that appeared as if it had been burned, together with the usual charcoal, was found at a depth of 16 ft. in the southeastern part. The bone had the appearance of having been partly decomposed, and, possibly with a mixture of shell, had formed a coating on the surrounding soil similar to that noted in connection with the pockets found with Burial 53. No artifacts were found in this deposit.

At a depth of 17 ft., in the eastern portion, a mass of animal bones was found in a much decayed condition, but identifiable as those of a canine, probably a fox. The bones were disposed in such manner as to indicate that the animal had been buried with some degree of attention. Nothing was found with them.

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EARTHENWARE OBJECTS

a-c, g-i, TOY VESSELS. d, f, KNOB HANDLES FROM UTENSILS. e, DISCOID

A deposit of burned bones was found 19 feet in depth in the northeastern section, extending N.E.—S.W., and covering a space 8 x 17 in., by 2 to 2½ in. in thickness. The bones had been calcined to such an extent as to have become broken into small pieces. On the middle of this deposit, separated from it by a thin layer of earth, was a round, flat stone, 6½ in. in diameter and 1¼ in. thick, showing evidence of slight use.

In the southeastern part of the mound, 9 ft. deep, was another deposit of animal bones, mostly of deer, that had been buried as a mass. Charcoal was scattered through the immediately adjacent soil.

Reference to stray bones found throughout the mound will be made in describing the bone artifacts.

HUMAN BURIALS

The features of the mound and its more or less unusual contents having been referred to, we will consider the burials of a more commonplace character. In all, seventy-five burials were unearthed, none of which was in a state of preservation to enable measurement, and all of them indeed were so greatly decayed as to be entirely beyond recovery.

Burial 1.—(Depth 2 ft. 9 in.) A small child, directed E.—W., head to E., extended on back. Entirely decayed excepting a few teeth, a clavicle, a fragment of the lower jaw, and parts of a few ribs. The bones that had retained their form were protected by what had evidently been a breastplate consisting of large shell beads. A string of smaller shell beads, by which the breastplate had been suspended, was found under the jaw; among these were two shell hair ornaments. About one foot southwest of and six inches above where the skull had been, were four discoidal stones, irregularly placed. Traces of charcoal were above and beneath the burial.

Burial 2.—(Depth 2 ft. 9 in.) Adult directed N.N.E.—S.S.W., head to S., lying on right side, knees flexed upward, hands in front of face. Bones generally soft, but some of them in fair condition. Under the jaw was a catlinite platform pipe (pl. XLIX, *a*) with the

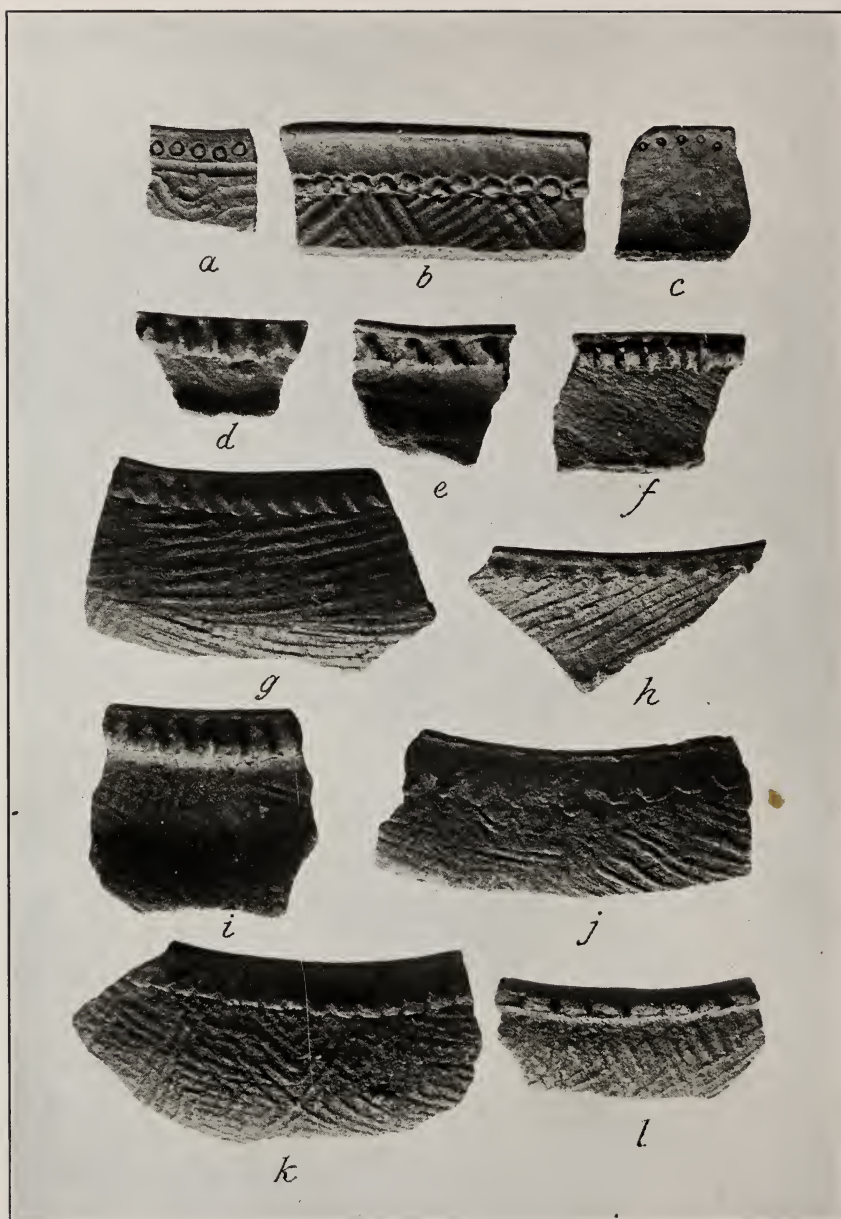
stem toward the feet, with *Marginella* shells in the pipe-bowl but which seemed to have been in a string that had been attached to the hole in the lower part of the pipe. Around the neck was a string of blue glass beads, which likewise seemed to have been attached to the pipe. On and under the scapulæ and pelvis were *Marginella* and other shell beads that evidently had been fastened to a shirt and leggings. Under the lower leg were two polishing stones and a small piece of ground rock-crystal. Between the knees and the vertebræ were two small stone discoids, one of them, green in color, found hollow-side down, being nearer the spine. Above the remains were traces of charcoal and deer bone, and a few potsherds. Under the skull and extending to the scapulæ was a thin layer of ashes, and under the pelvis, mixed with the shells above referred to, was a small, worked, triangular stone. By the feet was a small stone implement (pl. LV, *i*) that probably had been used in modeling pottery. (Pl. XIV, *a*.)

Burial 3.—(Depth 2 ft. 4 in.) Adult, directed S.E.—N.W., head to S.E., lying on face with legs flexed backward so that the feet touched the pelvis. On each upper arm was a broken copper arm-band that had been lined with bark. Under the right jaw was a mass of red paint, and beneath the chest was a breast-ornament consisting of 410 *Marginella* shell and glass beads. A small, long bird-bone (?) and two bone awls were at the upper part of the vertebræ. Extending from under the left arm-band to the feet was an irregular line of bird-bones, and under the left elbow was a small piece of micaceous stone. Beneath the entire body was a layer of red-burned earth resting on black ashes, evidently indicating that a fire had been kindled over the grave area before the interment was made. The bones of the skeleton were fairly well preserved, but the skull was crushed. (Pl. XIV, *b*.)

Burial 4.—(Depth 2 ft. 9 in.) Adult, directed E.—W., head to E., lying on right side with legs flexed; bones badly decayed and skull crushed. At the back of the scapulæ was a stone pipe (pl. XLIX, *e*), the bowl toward the feet, and beneath the pipe were four glass beads. A copper button lay at the base of the vertebræ, and another, together with two lead buttons, was above the pipe. There

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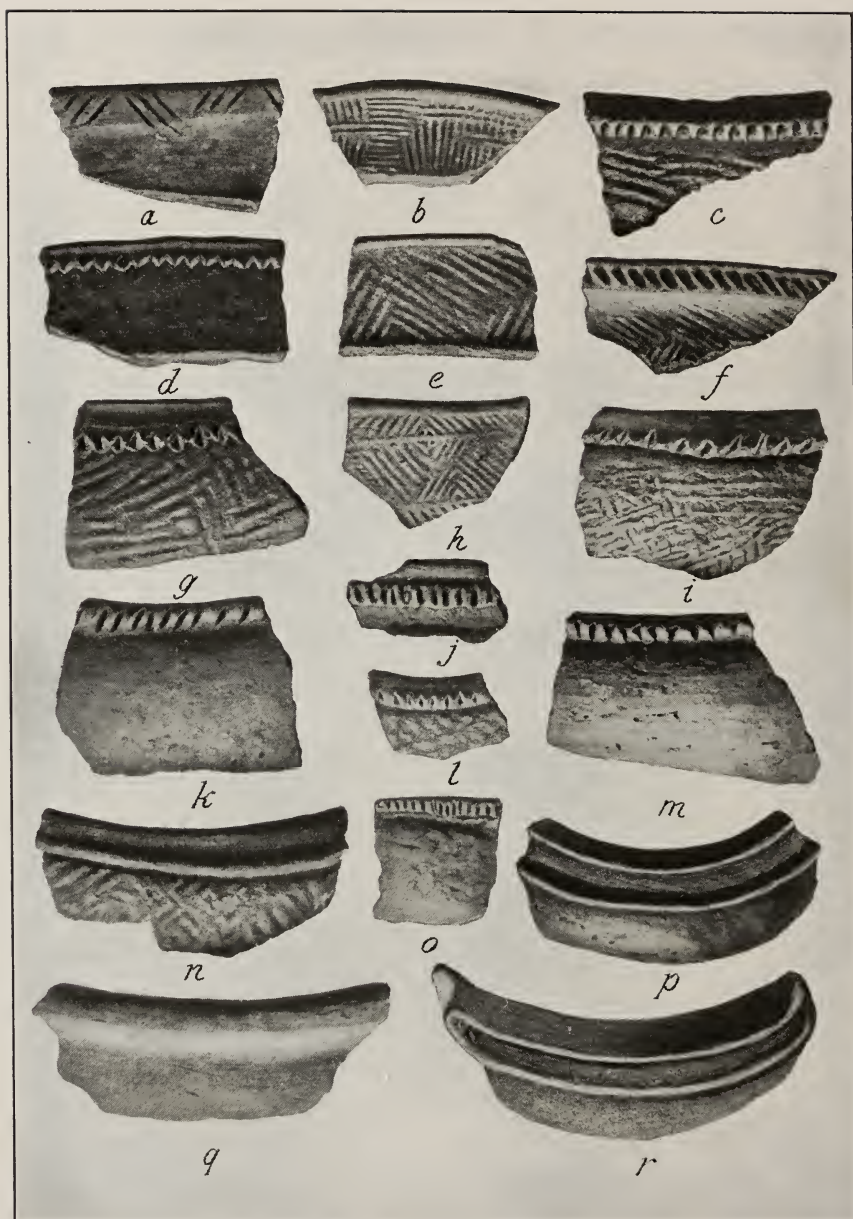
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EXAMPLES OF RIMS OF VESSELS

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EXAMPLES OF RIMS OF VESSELS

were also three lead buttons in front of the arms and three more near the feet. This skeleton also had been placed on a layer of red-burned earth, 2 in. thick, beneath which was a stratum of ashes 8 in. in thickness, and another thin layer of red-burned earth. (Pl. xv, a.)

Burial 5.—(Depth 3 ft. 8 in.) Adult, directed N.-S., head to N., lying on left side with hands under chin; legs greatly flexed backward so that the feet were against the hips. The skull, and indeed the entire upper part of the skeleton, were greatly decayed, many of the bones having disappeared. Around the neck was a necklace of shell and glass beads, and on one of the knees was a small piece of graphite.

Burial 6.—This burial has already been described in connection with an adjacent stone deposit. See pages 35-36.

Burial 7.—(Depth 4 ft. 5 in.) Adult, greatly decayed, only the teeth being well preserved. The head was directed approximately S., but not enough of the skeleton was traceable to determine whether the body had been flexed. In association with the teeth and the traces of the skull were 21 white shell beads, badly decomposed, varying in length from a quarter to half an inch. Slight traces of baked dark clay lay beneath the skull.

Burial 8.—(Depth 4 ft. 5 in.) Adult, found 5 ft. north of Burial 7. Only traces of the skull and teeth were observable, the remainder having disappeared through decay, except for discoloration of the soil. The burial, however, had been made with the head directed southward and the legs had probably been flexed toward the E. There were no accompaniments.

Burial 9.—This burial has been described in connection with an accompanying stone deposit near the middle of the mound. See pages 36-37.

Burial 10.—(Depth 1 ft. 5 in.) Faint traces of bones only, not sufficient to determine their character or the direction of burial. Accompanying these traces was an entire jar (pl. xxi), standing upright, and immediately back of it, *i. e.*, northward, was a fire-pit, filled with red-burned earth and ash, mostly the former, measuring 13 in. in depth and 8 in. in greater diameter. The top of the fire-pit was 1 ft. 7 in. below the surface of the mound.

Burial 11.—See page 37, note.

Burial 12.—(Depth 3 ft. 10 in.) This adult skeleton consisted only of traces, which sufficiently outlined the burial, however, to show that it had been flexed westwardly. With the outer shells of some of the teeth was an earthenware pipe, crudely made and without ornamentation of any kind, and a similar pipe lay in close proximity to the spot that had been occupied by the skull. It is evident that this burial had been disturbed by the excavation made when the waterpipe previously referred to (p. 3) was laid. Covering the entire space beneath the skeleton was a layer of red-burned earth and charcoal. Slightly west of where the smoking-pipes were found was a deposit of seven flat rounded stones lying on their sides, beneath which was a pocket of red-burned earth and coarse charcoal.

Burial 13.—(Depth 6 ft.) Adult, direction N.E.—S.W., headed N.E., lying on right side, the right leg flexed at a right angle, the other more extended. The skeleton was in bad condition, none of the bones being firm enough to remove and most of them being represented by little more than soil discoloration. At the neck were a fine leaf-shaped blade of flint (pl. LV, *a*), pointing toward the feet; 15 shell beads of two varieties, in a compact group, not in line as if the remains of a necklace; a shell disc or gorget, in three pieces, perforated as if for suspension, on which rested the flint blade and the shell beads; and an awl-like implement of antler, resting on the blunter end of the blade, but which evidently had not served as a handle.

Burial 14.—(Depth 6 ft.) Adult; on right side, skull directed E., arms flexed upward. Only half of the skeleton remained, and that in very bad condition. On the left forearm were the disintegrated fragments of a conch, the columella remaining, and a fine slate knife, $8\frac{1}{4}$ in. in length (pl. LVI, *b*).

Burial 15.—(Depth about 6 ft.) This adult skeleton also was greatly decayed, the skull being flattened to a pasty mass, but it was directed eastward. At the neck were two small univalve shell beads, too far decomposed to enable preservation.

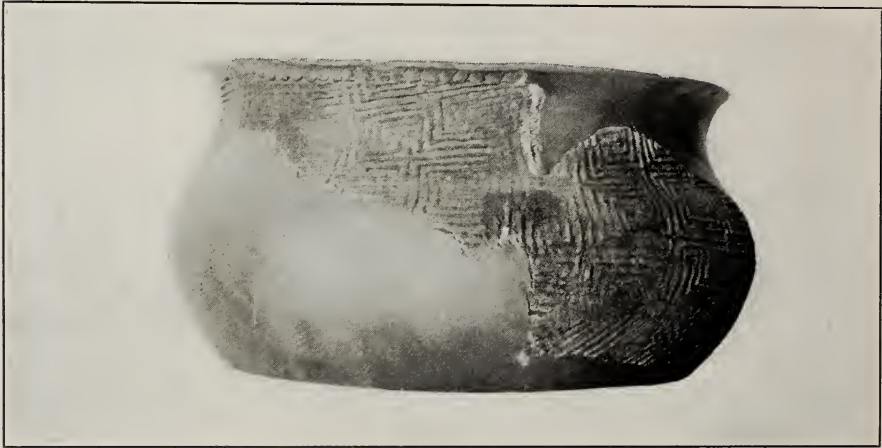
Burial 16.—(Depth $8\frac{1}{2}$ ft. beneath the slope and 18 ft. below the summit.) Adult, on right side, head toward E., legs flexed and

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a



b



c

arms drawn up at acute angles. The bones, which were little more than of the consistency of putty, lay on undisturbed brownish clay, the original base of the mound. There were no accompaniments.

Burial 17.—(Depth 9 ft. beneath the N.E. slope and 18½ ft. below the summit.) Adult, head directed S.E., legs and arms flexed as in the case of Burial 16, bones of pasty consistency. Faint traces of charcoal were found in the earth about the skeleton, but there were no artifacts. The burial lay on the sand of the original valley surface, almost directly above Burial 16.

Burial 18.—(Depth 7½ ft. beneath the slope and 19 ft. 2½ in. below the summit.) Adult, the skeleton being represented by little more than streaks of color, while the bones best preserved were as soft as the sand in which they had been interred. The grave, which had been made in pure sand, was outlined by a discolored area measuring only 3 ft. 2 in. by 2 ft., throughout which were particles of charcoal. The body evidently had been buried in the pit in a sitting posture. No artifacts whatever accompanied the remains.

Burial 19.—(Depth 10 ft.) Skeleton of adult, badly decomposed, lying on right side, skull directed E., the hands before the face; the lower right leg drawn up almost against the upper, the left leg extended almost straight outward from the body; the vertebræ had disappeared, and there was almost no trace of ribs or of the smaller bones. The burial was made entirely in sand on a gravelly bed, the sand being so wet that it could be readily molded in the hand. There were no accompaniments.

Burial 20.—(Depth 11 ft.) Adult, badly decomposed, skull directed E., arms at sides; upper legs outward at right angles with the trunk, lower legs flexed. On the skull and around the body were patches of charred material resembling bark. The burial lay on sand, which had been discolored by contact. No accompaniments.

Burial 21.—(Depth 3 ft. 10 in.) A child, lying on the left side, head directed N.E.; lower legs flexed backward, so that the entire grave, which was well defined by the dark soil caused by the de-

composition of the body, occupied a space of only 2 ft. 6 in. by 15 in. The remains were badly decomposed. There were no accompaniments.

Burial 22.—(Depth 4 ft. 10 in.) Child or adolescent, bones greatly decayed, only part being traceable. It lay on the left side, head directed N.E. Above the neck were four small shell beads, greatly disintegrated, and about the position of the left ear was a portion of what had the appearance of a shell ear-plug or possibly a hair-ornament, of limy consistency. On the chest lay a celt of slate, $7\frac{1}{2}$ inches in length. This skeleton lay only 21 inches west of Burial 21.

Burial 23.—(Depth 3 ft. 10 in.) The skull of this adult skeleton lay only 17 in. N. from Burial 21, the measurement being made from center to center of the two skulls. Of the remainder of the skeleton, the leg-bones and part of the pelvis were found 3 ft. west of the skull, evidently having been removed in digging the grave for Burial 21, and then reinterred, since if the body had been buried so that the head was directed eastward, as seems to have been the case from the position of the skull, it must have overlapped Burial 21. No artifacts were found with this skeleton.

Burial 24.—(Depth $5\frac{1}{2}$ ft.) Adult, head directed E.; legs sharply flexed backward, body on left side. The skull was greatly decomposed, no teeth were traceable, and little of the trunk remained. There were no accompaniments.

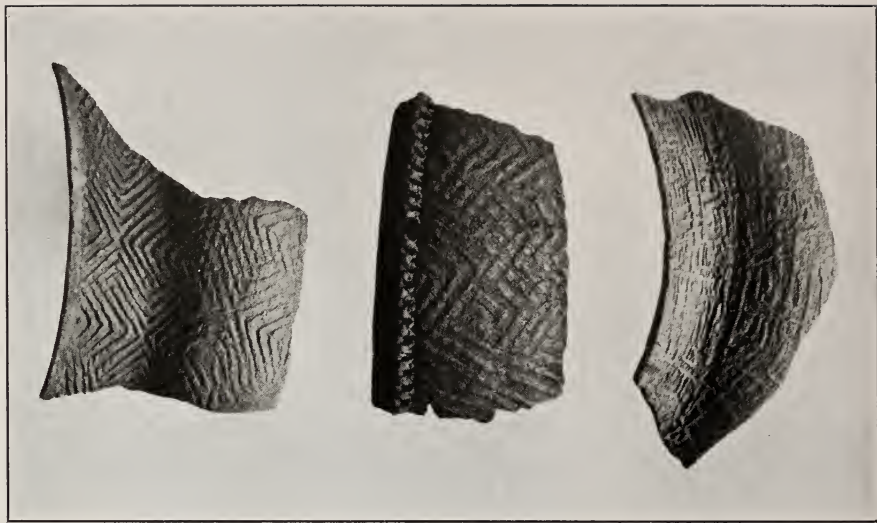
Burial 25.—(Depth $5\frac{1}{2}$ ft.) A child, skull only, in very bad condition, the teeth being represented only by their crowns. Possibly the remainder of this skeleton was dug away by a workman before its discovery. The body had been buried in an E.-W. direction, the skull pointing eastward and resting on its right side. Interment had been made in compact sandy clay, 14 in. above a sandy stratum. No mortuary objects were present.

Burial 26.—(Depth 7 ft.) The badly decomposed skull and only traces of the skeleton of an adult which lay on the left side, head directed eastwardly, with slight traces of shells about the neck.

Burial 27.—(Depth 10 ft.) The skull and the leg-bones of this adult skeleton were the only parts remaining, and these were dis-

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integrated from decay and the skull crushed. The body seemed to have been buried on its left side, as nearly as could be determined from the faint traces of the bones of the trunk. The skull pointed eastwardly; the legs were greatly flexed. There were no accompaniments.

Burial 28.—(Depth 5 ft.) This insignificant burial had no accompaniments. The skeleton lay on its right side, the skull, completely flattened, directed eastwardly. The bones of the trunk were merely traceable and the leg-bones were hardly distinguishable.

Burial 29.—(Depth 4 ft. 6 in.) This skeleton was sufficiently preserved to show that the skull was directed in a southerly direction, but its condition was so poor that it was not possible to determine any flexion. There were no artifacts.

Burial 30.—(Depth 3 ft. 7 in.) This adult had been buried with the head toward the northeast, but only the leg-bones, part of the vertebræ, and faint traces of other bones, probably arms, were visible, the skull being completely missing. A rude hammerstone was with the remains, but as many such were found throughout the mound, it probably had no direct association with the burial.

Burial 31.—(Depth 6 ft. 3 in.) The remains of this burial consisted of the skull and a clavicle of an adult. The skull lay on the left side, and had been directed eastwardly when the interment was made. There were no artifacts.

Burial 32.—(Depth 10 ft.) Adult, lying on left side, skull directed E.N.E., the body so flexed that from the hips downward the bones trended N.W.-S.E. The skull lay 8 in. lower than the body, the hips and knees being elevated to that extent, except that the skull was greatly flattened by pressure and decay. There were no accompaniments. The earth in which interment had been made contained many small pieces of charcoal and a few small potsherds, and the burial was above the sand stratum in which other burials in the vicinity were unearthed. A thin stratum of yellow clay, not exceeding five inches in thickness and extending over a length of seven feet, lay above the skeleton. This clay had been deposited purposely, as it occurred above the mound base and had been dug through in making the grave.

Burial 33.—(Depth $9\frac{1}{2}$ ft.) Adult, lying on left side, headed N.E., legs strongly flexed backward. A shell bead and a shell pendant or other ornament probably made from the columella of a conch, lay below the former position of the right ear. The skull was entirely flattened.

Burial 34.—This burial has already been described in connection with a stone grave. See page 19.

Burial 35.—(Depth 10 ft. 6 in.) Adolescent, head directed s.w., the first instance of such. The leg-bones were flexed rather sharply backward. There were no accompaniments.

Burial 36.—(Depth 5 ft.) Adult, lying on right side, head directed N.E., legs flexed at an acute angle. This skeleton, which was greatly decayed, had no artifacts in association.

Burial 37.—(Depth 11 ft. 6 in.) Adolescent, lying on its right side but directed eastward, knees drawn closely to front of body. So greatly flexed was this badly decomposed skeleton that the length as it lay was only 2 ft. 10 in. There were no accompaniments. This burial was directly on the sandy base of the mound, a foot lower and partly under Burial 35.

Burial 38.—(Depth 10 ft.) Adult, greatly flexed, the head to the S.E. and the feet toward the N.W., the lower legs drawn backward against the pelvis. The axis of the grave was 20° east of north. There were no accompaniments.

Burial 39.—This burial has been described in connection with a stone grave. See page 19.

Burial 40.—(Depth 8 ft.) Adult, directed E.-W., with head to E. The body (only the skull and a humerus remained) lay on its right side on sand at the base of the mound. No artifacts were found in association.

Burial 41.—(Depth 14 ft.) Adult, directed N.E.-S.W., head toward N.E. The flexed body was on its right side, but the skull rested on the occiput. The underlying stratum was of mixed clay and sand. The legs and pelvic bones were in a better state of preservation than the skull, which was crushed and of the consistency of putty. Under the shoulder there was a layer of carbonized material, averaging half an inch in thickness, which included

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small sections of twigs. Near the pelvis was a fragment of a small earthenware vessel that seems to have had no immediate association with the interment.

Burial 42.—(Depth 14 ft. 6 in.) Adult, direction S.E.—N.W., the head directed S.E.; body flexed, on right side. Most of the bones, including the vertebræ, were definable. Nearly touching the top of the skull was a portion of the lower jaw of a deer, and near it a piece of quartz crystal and a bear-tooth.

Burial 43.—(Depth 10 ft.) Adult, directed N.—S., the head toward the S. The body lay on its left side and was flexed. Only the crushed skull, a portion of the pelvis, and the femora retained sufficient form to enable identification, but there were traces of other bones. Beneath the skull a small piece of shell was found, and near it a round piece of graphite and a small piece of rock crystal.

Burial 44.—(Depth 14 ft.) Adult, directed S.E.—N.W., with head toward S.E., body extended on back, face upward. The lower parts of the femora had completely disappeared, and there was no trace of the bones of the lower legs and feet. Just above the pelvis were two pipes, one of earthenware, the other of stone, the former resting on the latter. Near the pipes were several small pieces of mica, and a small mica flake was found near the chin. Six inches below the pelvic arch, between the femora, was a flat unworked stone that probably had no immediate association with the remains.

Burial 45.—(Depth 9 ft.) Adolescent, extending S.E.—N.W., the head directed S.E., face upward, body flexed. The skull and the femora were the only bones remaining; the former extended at right angles to what had been the axis of the body. On the bottom of the grave was a number of very small pebbles, placed there evidently by design. Three feet southwest of the knees of the skeleton, and about 18 in. lower down, was a large stone celt, which evidently had not been deposited with this burial.

Burial 46.—This burial has been described in connection with the deposit of the copper celt, etc. See page 22.

Burial 47.—(Depth 10 ft.) Adult, extending S.E.—N.W., flexed so that the head and face were directed S.W. The body was so bent

that the knees almost touched the nasal bone. The bones were fairly well preserved, the ribs being firm enough to enable the separation of the earth from them—an unusual condition at Nacoochee. The body lay on its left side, the left humerus parallel with the body. This arm was flexed, the fingers resting on the skull. Two small pieces of shell were found near the neck. (Pl. xv, *b*.)

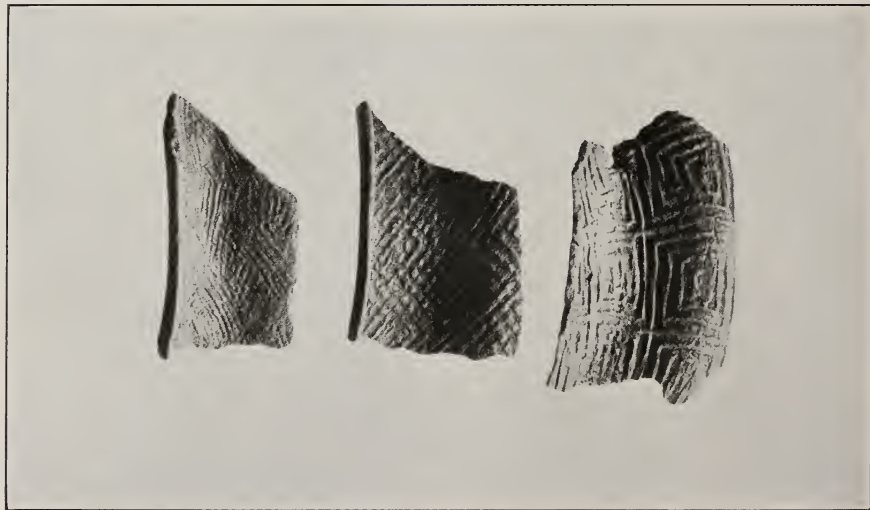
Burial 48.—(Depth 9 ft.) Adult, N.-S., head toward N.; body lying on left side; legs and arms greatly flexed, the elbows almost touching the knees and the hands resting under the chin. The skull was crushed and the other bones were too soft for removal, the vertebræ and the ribs being indicated only by light patches in the darkened soil. On the lower vertebræ was an earthenware pipe, broken into nine pieces (pl. XLVI, lower left-hand figure), probably at the time the grave was filled, as a stone large enough to have caused the damage was found nearby. (Pl. XVI, *a*.)

Burial 49.—(Depth 7 ft. 10 in.) Adult, directed N.E.-S.W., head toward N.E., face down. The upper part of the body was extended and the arms rested at the sides. The skull, pelvis, and leg-bones were crushed and parts of them were decayed, and there was no trace of vertebræ or ribs. The femora were slightly angulated and the lower leg-bones bent upward. Nothing was found immediately with the burial, but two feet south of the well-defined grave area a fragmentary jar was unearthed, with the neck part upward, partly filled with black material solid enough for preservation. The extent of the disturbed earth was indeterminate, but it may have extended beyond the darkened soil immediately beneath the skeleton, hence the jar may have been designed to accompany this burial.

Burial 50.—(Depth 12 ft.) Adult, directed N.E.-S.W., head toward N.E.; body flexed, the knees being bent upward, touching the arm-bones. All the bones were greatly decayed and crushed. On the chest were the remains of a piece of matting (pl. XVI, *b*), beyond preservation. Near the body were a few very small pieces of shell. A number of animal bones mixed with charcoal were scattered through the earth surrounding the burial, which contained also a number of small chips of white and rose quartz.

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Burial 51.—(Depth 16 ft. 6 in.) Adult, directed S.W.-N.E., the skull S.W. The body had been flexed, but no other features of the burial were determinable owing to the advanced state of decay, only a portion of the skull, a femur, and a few other fragmentary bones being present. On the surfaces of the skull and the other bones there was a black incrustation of indeterminate character, and above and below the bones were a number of partially burned animal bones and several large pieces of charcoal. There were no artifacts.

Burial 52.—(Depth 18 ft.) Adult, directed N.E.-S.W. This skeleton lay in moist earth, and the bones were so soft and lacking in distinctive coloring that the entire upper part was removed by a workman before the presence of the burial was noted. No artifacts were found.

Burial 53.—This burial in a stone grave has already been described. See page 25.

Burials 54-56.—These burials have already been described in connection with the five pockets at the base of the eastern side of the mound. See pages 32-33.

Burial 57.—(Depth 19 ft. 6 in.) This burial consisted only of a portion of the jaws of an adult which showed the lines of a few of the upper and lower teeth, together with faint traces of other bones. The grave had been lined with bark. As it was not possible to determine the direction of the burial, and as the limits of the grave were not well defined, it could not be learned whether the skeleton had extended under the disturbed area and Pocket 5 earlier described (p. 33), or had been directed eastwardly. There were no accompaniments.

Burial 58.—(Depth 12 ft.) Adult, directed N.E.-S.W., with head toward N.E. The body lay on its right side, the legs drawn up toward the trunk. A small discoidal stone was found above and within an inch of the pelvis.

Burial 59.—(Depth 18 ft.) Adult, directed N.E.-S.W., with the head toward the N.E. The body lay on its right side, the legs flexed. The skeleton was represented only by portions of the skull and the leg-bones, the other bones having disappeared through

decay. The grave had been lined with bark. One foot above the skull and 18 in. northeast of it was a stone celt, and near it three small arrowpoints, similar in size, form, and material to those found with Burial 53, the skull of which was only a few feet from that of Burial 59.

Burial 60.—(Depth 6 ft. 5 in.) Adult, buried probably in an E.-W. direction, with the head toward the E. All that remained of the skeleton were the femora and part of the pelvis. The legs had been flexed. About a foot from the burial, and extending southward from it about six feet, was a layer of large pieces of charcoal mixed with carbonized cane, suggesting a former shelter like that previously described as having been found near the summit of the mound. An inch above the bend of the knees was a large stone celt, lying on its side with the cutting edge toward the north, generally similar in size and shape to the celts found with Burials 53 and 59.

Burial 61.—(Depth 6 ft. 9 in.) Adult, directed S.E.-N.W., with the head toward the S.E. The skeleton was represented only by the skull and the femora, the skull being crushed. The position of the femora indicated that the legs had been flexed. The grave had been lined with bark, and an unusual quantity of charcoal was over and under the bones. A piece of disintegrated shell, about an inch in length, was found under the jaw.

Burial 62.—(Depth 7 ft. 1 in.) Adult, lying on its left side, directed S.E.-N.W., with the head toward the S.E., the legs flexed. The only recognizable portions were the crushed skull, the pelvis, and the femora. The bark lining of the grave of Burial 61 extended under this skeleton also, and this, with the general discoloration, indicated that the two bodies had been buried at the same time. In the soil surrounding the two burials were a number of flattish pebbles, over each of which was about a double handful of clear sand. There were no artifacts.

Burial 63.—(Depth 10 ft.) Adult, directed S.E.-N.W., head toward S.E., body resting on left side, legs flexed, face turned S.W. Only the skull, leg-bones, and one arm were present; the skull was crushed and all the bones were badly decomposed. Resting between

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PARTS OF FIVE EARTHENWARE PADDLES USED IN ORNAMENTS POTTERY

the femora and where the lower vertebræ would have been, was a large stone celt, with the blunt end toward the head, the implement parallel with the direction of the body. Six inches southwest of the feet was a large piece of charcoal, and a piece of rock crystal was found near the trunk.

Burial 64.—(Depth 16 ft. 6 in.) Probably a young adult, the only portions of the skeleton of which were the leg-bones, which had been flexed. There were no accompaniments.

Burial 65.—(Depth 8 ft. 10 in.) Adult, directed S.E.—N.W., with the head toward the S.E. The body lay on the left side, the legs flexed. The bones were much larger than the average. No artifacts were found with the remains.

Burial 66.—(Depth 16 ft. 10 in.) Adult, directed N.E.—S.W., with the head toward the N.E., body lying on right side and flexed. The bones were all greatly decayed and the skull was crushed. Nothing was found with the burial.

Burial 67.—(Depth 17 ft. 9 in.) Adult, of which only the leg-bones and a portion of the pelvis were traceable. The orientation was indeterminate. No artifacts accompanied the burial.

Burial 68.—(Depth 18 ft.) A number of bone fragments only, none identifiable except those of the legs. The discoloration of the grave earth was well defined, and judging by its extent the skeleton had probably been that of an adult which had been flexed. It was not possible to determine the direction. No accompaniments.

Burial 69.—(Depth 18 ft.) The bones of this skeleton had disintegrated to such an extent that only a portion of the skull remained. The direction of the burial was not determined, and there were no artifacts.

Burial 70.—(Depth about 6 ft.) This skeleton was brought to light by the cave-in of the bank exposed by the great trench in the eastern section of the mound, following a heavy rain. Several teeth and a few fragments of bone were found, but careful search through the fallen material failed to reveal any other parts of the skeleton, and the exposed earth contained no grave discoloration. Directly above the point whence the bones came, there was a thin layer of charcoal about eight feet in length. With the bones and

teeth were a fragmentary jar, a bone pin (fig. 61), and the heads of two shell pins identical in form to those represented in fig. 59.

Burial 71.—(Depth 8 ft.) A few teeth and fragments of bone were all that were left of the skeleton of this young person, and no artifacts were found with it.

Burial 72.—(Depth 14 ft.) Adolescent, directed N.E.—S.W., head toward N.E., back of skull turned to N.W.; body flexed in such manner that the vertebræ almost formed a semicircle. Most of the bones were in their relative positions, but a few had been scattered, perhaps by burrowing animals. Many of the bones were crushed and some were disintegrated, but the vertebræ were in better condition than any other found in the lower part of the mound. Near the pelvis, clam-shells in fragments were found, two of them in a fair state of preservation. In the earth just above the body were a pitted hammerstone, a stone disc, and two potsherds.

Burial 73.—(Depth 12 ft.) Adult, directed E.—W. with head toward the E. and with body flexed as indicated by the curve of the vertebræ, which, however, was represented by little more than a line of color. The skull, the arm and leg-bones, and the pelvis were in better condition, but no other bones were in evidence. There were no artifacts.

Burial 74.—(Depth 16 ft.) The grave was well defined by the usual discoloration and was within a foot of the stone stratum previously described (see p. 34); but the skeleton had almost disappeared through decomposition. Parts of a *Busycon* shell were found with the bones.

Burial 75.—(Depth 12 ft. 6 in.) A child, directed S.W.—N.E., head toward S.W., an unusual but not unique direction in this mound. The body lay extended on its back, legs flexed, the face upward. The length of the skeleton from the skull to the ends of the leg-bones was only 22 inches; it was the only child's burial found in the lower reaches of the mound, a not surprising fact when it is considered how poorly preserved were the remains of adults. Nothing in the way of artifacts was found.

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SUMMARY OF OBSERVATIONS ON THE MORTUARY REMAINS

It has been noted that all the skeletal remains uncovered at Nacoochee were in such a decayed condition that in no instance was it possible to preserve them for measurement; indeed in many cases the bones were so greatly decomposed that they could be traced only with difficulty. Considering the excessive precipitation in the Nacoochee valley, this condition is not surprising.

Of the 75 skeletons unearthed, 56 were of adults, 7 of adolescents, 4 of children, and 8 were unidentifiable as to age. Considering the condition of the skeletons of the adults, it was not to be expected that a greater number of burials of children would be encountered, especially as the presence of relatively few of the remains was revealed by accompanying artifacts.

With respect to orientation, it is observed that 48 of the dead were interred with the head directed eastwardly (E. 19, N.E. 19, S.E. 10), about 6 southwardly, 3 southwestwardly, 3 northwestwardly, and 1 in a sitting posture, while 14 were of indeterminate direction.¹ In regard to age, we find that the direction of burial bears no special signification, as might have been expected, the summary of the data in this respect being as follows:

Adults: E. 14; N.E. 16; S.E. 9; S. 5; N. 3; S.W. 1; sitting 1; indeterminate 6.

Adolescents: E. 2; N.E. 2; S.E. 1; S.W. 1; indeterminate 1.

Children: E. 2; N.E. 1; S.W. 1.

As to the position in which the dead were deposited in the graves, we find flexion of the body and especially of the legs quite common at Nacoochee; indeed it was in exceptional instances that extended skeletons were met. Of the 51 burials whose positions in the graves were determinable, 47 were flexed in varying degrees, while only 4 were buried extended at full length—two adults, one adolescent, and a child. Of 42 skeletons, 19 lay on the right side, 16 on the left side, 4 on the back, 2 face down, and one was in a sitting position as above noted.

In the matter of mortuary artifacts, 27 of the 75 burials were

¹ Adair (op. cit., p. 182), writing of the Southern Indians without specifying the tribe in this case, refers to the burial of a chieftain in a tomb "with his face towards the east."

accompanied with objects of more or less importance, 11 with objects of practically no significance (such as may have found their way into the graves through accident at the time of burial), while 37 of the burials had no accompaniments of any description. Nine of the graves showed evidence of having been lined with bark, and with four of the interments articles of European manufacture were found. These last burials were respectively at a depth of 33, 28, 33, and 44 inches beneath the summit, indicating quite clearly that the mound had reached a height probably not far from its maximum during the historical period. It should not be forgotten that about two feet of the summit had been removed in recent time. With none of the deeper burials were objects of European provenience found.

In the latter part of the eighteenth century Adair wrote¹ that "the Cherokee of late years by the reiterated persuasion of the traders, have entirely left off the custom of burying effects with the dead body; the nearest of blood inherits them." This statement, however, hardly applies to the inhabitants of Nacoochee, as there was no more indication that they had abandoned the custom of making funerary deposits during the later occupancy of the mound than in earlier times.

Further summarizing the data derived from the graves, we find their distribution as to depth beneath the surface of the mound as follows:

Surface to	3 feet	5	Burials
3 +	" 6 "	20	"
6 +	" 9 "	14	"
9 +	" 12 "	15	"
12 +	" 15 "	8	"
15 +	" 18 "	10	"
18 +	" "	3	"
Total		75	Burials

This distribution is presented merely as a matter of record, being admittedly of little value so far as the aggregate of burials in the mound is concerned, a relatively greater amount of digging being done in the upper than in the lower levels.

¹ James Adair, *History of the American Indians*, p. 178, London, 1775.

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SHERDS OF VESSELS STAMPED WITH CURVILINEAR PATTERNS

MATERIAL CULTURE

POTTERY

It has already been observed that there was a paucity of earthenware vessels found as funerary accompaniments at Nacoochee, and indeed entire vessels of any kind were quite rare. Fragments, however, large and small, were present in thousands, especially under the surface of the slope and at the base, where the receptacles, no doubt broken in use, had been cast during the occupancy of the mound. In a limited number of instances related sherds were found together, enabling more or less complete restoration, but in others only relatively small parts of the utensils were recoverable, yet sufficient to enable a study of their general character, former shape, and ornamentation.

CHARACTER OF THE EARTHENWARE

By far the greater number of the receptacles consisted of cooking-pots or water-jars of black or dark gray ware, which ranged in size from a few inches in diameter and height to one that measures 60 in. in maximum circumference and 15 in. high, while another is only slightly smaller; and indeed certain sherds indicate, from their size and curvature, that they are parts of vessels of even greater dimensions. Some large sherds of soft reddish ware were found, as well as other sherds of small bowls and jars, polished red inside and out, and without decoration. Almost invariably the ware is rather fragile, not only from long-repeated subjection to heat while in use for cooking, but owing also to the inferior quality of the paste, which was tempered with sand, often micaceous, or with sand and ground shell, or with shell alone, particles of which are plainly visible in a limited number of the vessels or their fragments. There is also reason to believe that pure mica was ground and mixed with the clay as a degreassant.

Timberlake,¹ writing in 1761, stated that the Cherokee "have two sorts of clay, red and white, with both of which they make excellent vessels, some of which will stand the greatest heat." Adair,² writing about the same period, said:

¹ Henry Timberlake, *Memoirs*, p. 62, London, 1765.

² *Op. cit.*, pp. 424-425.

"They make earthen pots of very different sizes, so as to contain from two to ten gallons; large pitchers to carry water; bowls, dishes, platters, basons, and a prodigious number of other vessels of such antiquated forms, as would be tedious to describe, and impossible to name. Their method of glazing them, is, they place them over a large fire of smoky pitch pine, which makes them smooth, black, and firm. Their lands abound with proper clay, for that use; and even with porcelain, as has been proved by experiment."

It may here be remarked that every variety of pottery found (with the exception of the painted effigy jar hitherto described, which evidently was intrusive), in both shape and ornamentation, was gathered at all levels of the mound, suggesting that the occupants manufactured all the types of earthenware throughout the occupancy of the site. The ware is of the typical Southern Appalachian form and style, in no particular respect different from that of other pottery made by the Cherokee in early times.¹

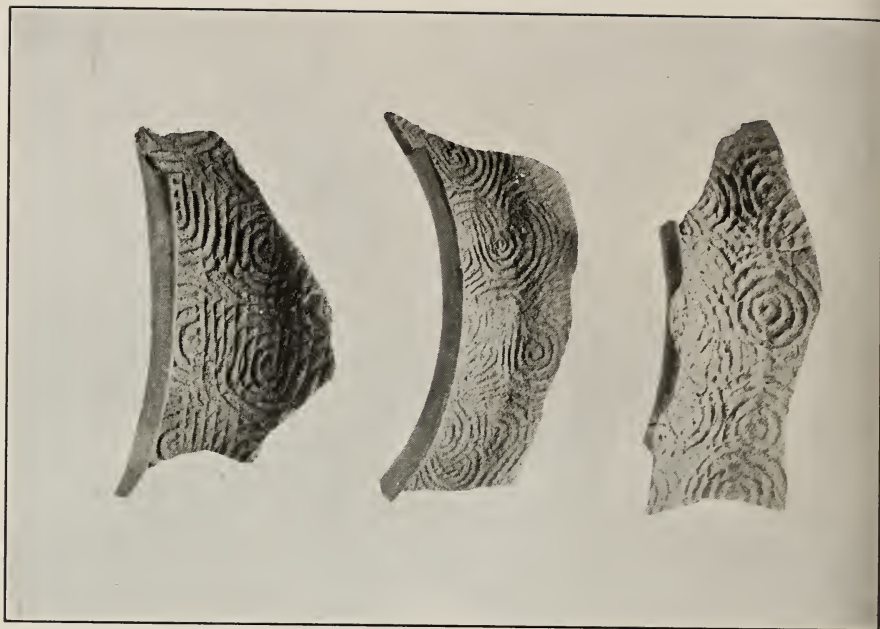
In thickness the receptacles average from about three-sixteenths to a quarter of an inch, even the largest ones being comparatively thin-walled. The inside of the vessels was almost invariably smoothly finished, and in many cases it was given a black coating and polished, apparently to overcome the porosity to some extent and to facilitate cleaning. Probably it was this blacking and polishing of the inside of the pottery that Adair mentions.

Regarding the form of the vessels, the larger specimens, or rather those that admitted of restoration, are chiefly globular, with wide mouth, somewhat constricted neck, outcurving rim, and with the maximum diameter at the shoulder (pl. xvii, xviii). In this type the bottom is generally rounded, but some sherds, evidently of jars, show almost flat bottoms. Other receptacles take the form of deep bowls, the body shaped like the jars from the shoulder to the base (pl. xix). Others still had their greatest diameter at the somewhat flaring rim, the sides swelling considerably at the middle, or else to only a slight degree, then tapering gradually to the base. Unfortunately no complete specimen of this form of jar was obtainable, but the major part of each of two specimens is shown on plate

¹ See Holmes, *Aboriginal Pottery of Eastern United States, Fifteenth Annual Report of the Bureau of American Ethnology*, Washington, 1903.

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xx. Some of the jars curved outward so slightly as to have been practically cylindrical.

The only jar found by us that may be regarded as complete (as it lacked only a small piece at the rim) was a mortuary vessel found with Burial 10. This little vessel (pl. xxi) stands $5\frac{1}{4}$ in., with a circumference of 18 in. at the middle; it is heavy in comparison with its size, and is of coarse ware and crude workmanship; but an attempt was made to relieve its homeliness by impressing in its surface two double bands with the two ends of a cane probably cut off at the nodes, or with two canes varying slightly in size.

In addition to this jar, however, there is another entire vessel from Nacoochee, a fine bowl that had been found by Captain Nichols and procured from Mrs Payne. This receptacle stands $7\frac{1}{4}$ in., is $13\frac{3}{8}$ in. in diameter at the rim, and measures 47 in. in circumference of body. While rather rough below the shoulder, the upper part of the bowl is ornamented with eight incised scrolls, connected at the top with straight bands which also form parts of simple geometric devices which fill the intervening panels. This bowl is illustrated in plate XIX, *b*.

Toy Vessels.—Five tiny vessels, evidently intended for toys and possibly all but the largest one made by children, are illustrated in plate XXII, *a-c, g-i*). The one designated *c* is thick and clumsy, but with the under-body polished as if from use. A large grain of sand is embedded in 'the inner' wall, showing with what carelessness the little bowl was formed. The largest vessel (*b*), a toy bowl, has been restored, but enough remained to enable determination of the entire form and character. It is smooth within, but almost unfinished and checked outside, and its shoulder-like rim is rudely incised by way of ornamentation. The smallest one shown (*g*), only an inch and a quarter long, has almost the density of stone. Much of the body is taken up by four disproportionately large nodes, while the receptacle part is large enough only to receive the tip of the little finger.

Dippers.—Fragments of handles and bowls of small earthenware dippers are the only evidence that such utensils were in use at Nacoochee, no complete ones being found.

Rims.—The rims of the vessels are of considerable variety, both in form and in ornamentation. The dentate border (shown in various examples in accompanying illustrations, especially in pl. XXIII, XXIV, and in fig. 5-14), which varies greatly in character and spacing, as well as in its relation to the lip of the vessel, was evidently the favorite device employed in embellishing the rims, judging by the large proportion of this kind found. In some

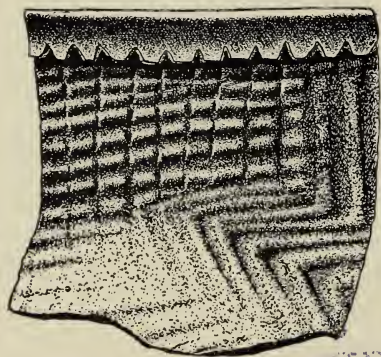


FIG. 5.—Dentate rim ornamentation.

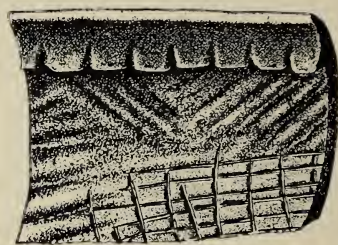


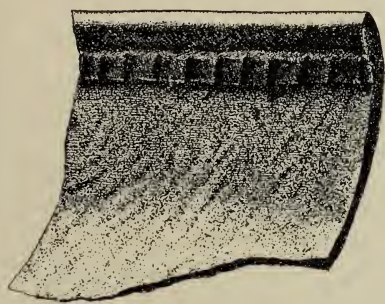
FIG. 6.—Dentate rim ornamentation.

examples the band is truly dentate or beaded, in others it consists of a series of rude nodes regularly or indifferently spaced, and in still others there is little more than a suggestion of ornamentation, the spaces being indicated by crude incisions, or the clay having been pressed into a semblance of finish by means of a blunt instrument, the end of a cane-stalk, or even with the finger-tip, which in some cases left its prints in the clay. Only in exceptional instances is the lip unaccompanied with an ornamental band or border of some kind, and in these the decoration of the sides with stamped or incised devices usually commences immediately beneath, as shown in the illustrations. In almost all cases the ornamental rim was applied as a separate strip of clay during the process of manufacture, and in these instances the body of the vessel had been ornamented with a stamped design and was almost if not quite dry when the rim portion was luted on. This process made the attachment of the rim quite insecure, as shown by a number of

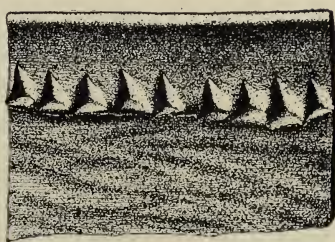
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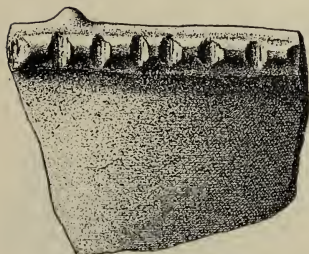
SHERDS OF VESSELS STAMPED WITH CURVILINEAR PATTERNS



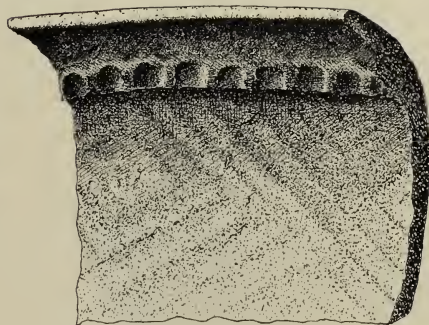
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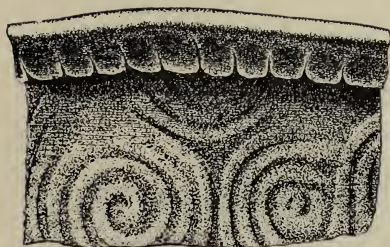
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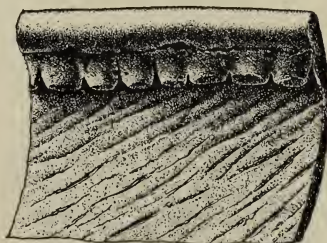
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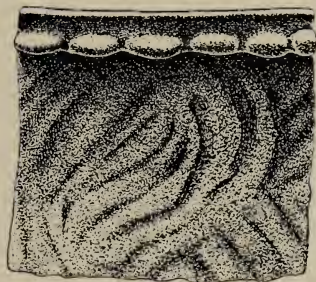
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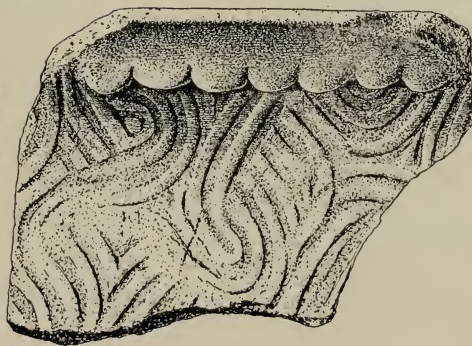
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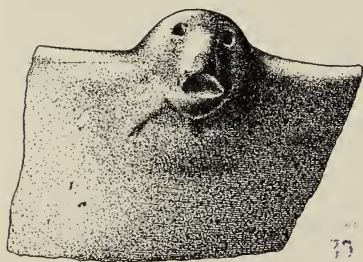


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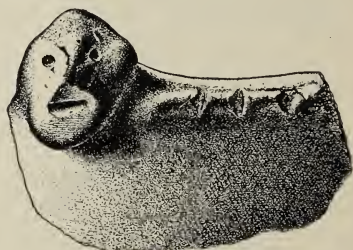
FIGS. 7-14.—Examples of rim ornamentation.

sherds from which all or a part of the ornamented rim has fallen away, exposing the stamped surface beneath. The reason for this seems obvious, for it was necessary to stamp a pattern on the walls of the vessel while the clay was still soft, which it probably would not have been had the potter waited until she first applied the sometimes tedious rim ornamentation.

In addition to the dentate or beaded form of rim embellishment, we find on vessels with stamped patterns on the body a number of other decorative devices at or near the lip, as shown in several of the illustrations. Noteworthy among them are the rims on which are present more or less grotesque human heads, some



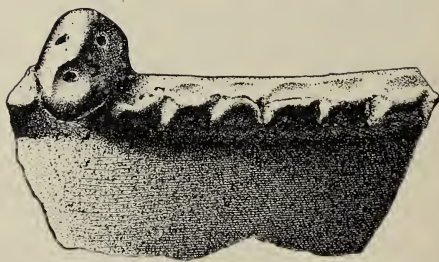
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16



17



18

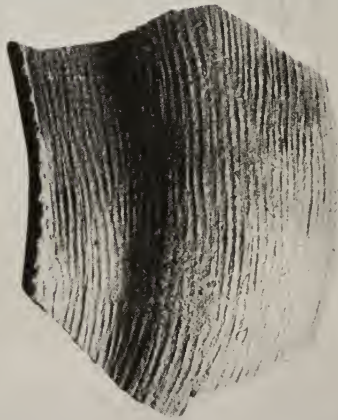
FIGS. 15-18.—Grotesque heads on rims of vessels.

flanked with a row of nodes (fig. 15-19). Unfortunately these exist in the collection only in the form of sherds, yet they exhibit something of the sculptural art of the Nacoochee potters. Other sherds show each a node projecting from the rim, flanking which was a line of round depressions seemingly made with the end of a small cane (fig. 20), and the same decorative device was employed

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a



b



c



d



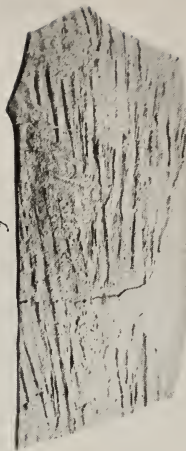
e



f



g



h



i

about the rims of two other vessels, one of plain red ware without additional rim elaboration (pl. XXIII, *c*), the other containing a more deeply punctured series of holes (made probably with a small blunt



FIG. 19.—Grotesque head on rim of vessel.

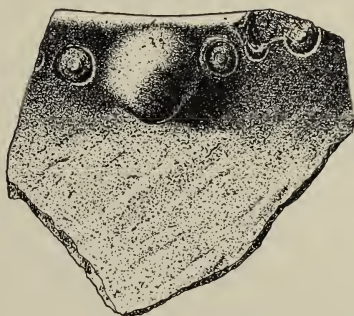


FIG. 20.—Node and punctate decoration.

twig) which appear on a ridge forming the rim, the holes terminating at a prominent node which projects therefrom (fig. 21). It is difficult to distinguish these devices from the knob handles to be described; indeed the modeled heads referred to were doubtless designed primarily for utility, since they would have served the same function as the simple knobs or lugs often found on rim fragments from Nacoochee and elsewhere, to be mentioned later.

Another form of decorative border was produced

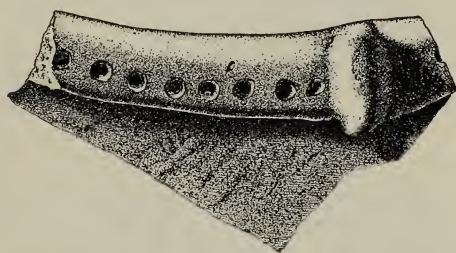


FIG. 21.—Rim with node and punctate decoration.

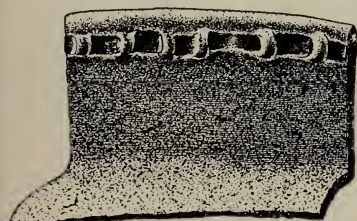


FIG. 22.—Rim ornamented by punching the clay with a cane.

by punching the clay, while moist, with the end of a cane or other tube as shown in fig. 22, which presents an ornamental band made by cutting out the alternate spaces with a small sharpened cane that left the grain of the edge impressed in the clay.

A sherd of an unusually thick vessel whose wall measures nearly three-eighths of an inch below the lip, is also of exceptional plainness of rim, which was simply rounded over in the form of a heavy lip, without any ornamentation (pl. XXIV, *q*). Somewhat related in

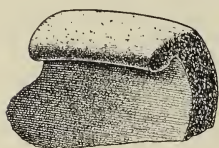
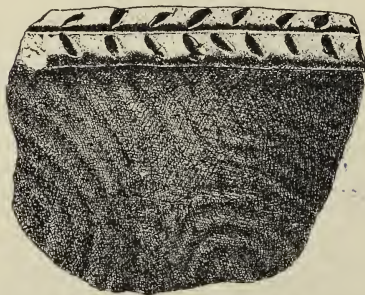


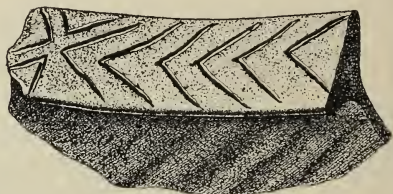
FIG. 23.—An incurving rim.

form is the rim of another vessel whose only ornamentation consisted of series of incised triple oblique lines, alternating right and left (pl. XXIV, *a*). A diagonal punctate decoration, effected by means of a small hollow cane or twig, appears near the edge of the flaring rim of a sherd shown in plate XXIV, *f*.

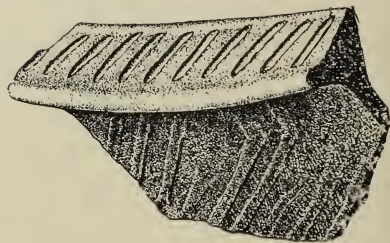
In only one specimen, a small sherd of reddish ware, does the rim curve inward (fig. 23).



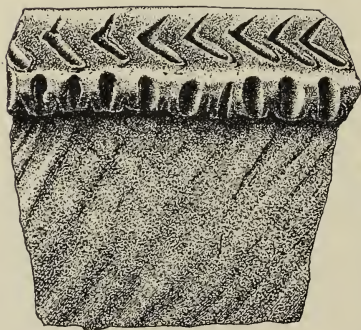
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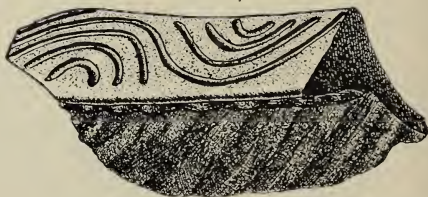
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27



25



28

FIGS. 24-28.—Shouldered rims with incised decoration.

The rims thus far described bear their ornamentation on the face or side, beneath the edge. There are a few sherds, however,

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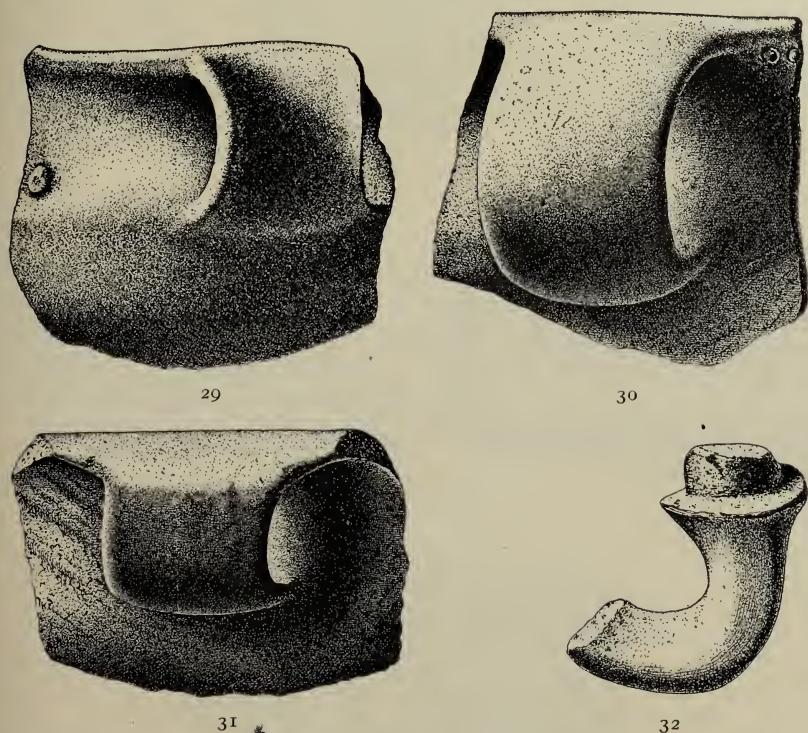


EARTHENWARE STAMPED WITH CORD-WRAPPED PADDLES



SHERD OF VESSEL BEARING STAMPED CURVILINEAR PATTERN CON-

that show a decided shouldering or squaring of the rim, the neck of the vessel extending downward from the center of the rim in every instance but one. This square lip is embellished with incised devices, as shown in figs. 24-28. Three of these examples exhibit parallel acute angles directed the same way; one consists of parallel vertical lines; another, of a central horizontal line bordered on each side with depressions made apparently with the end of a small sharpened stick; while the most elaborate pattern of all

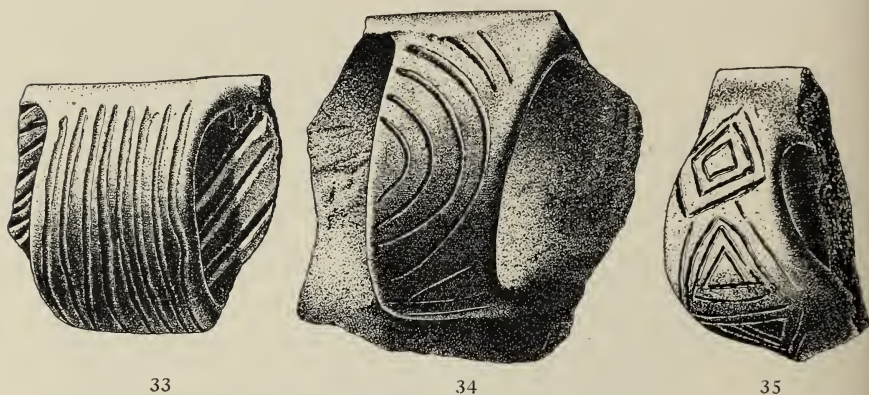


FIGS. 29-32.—Plain loop handles.

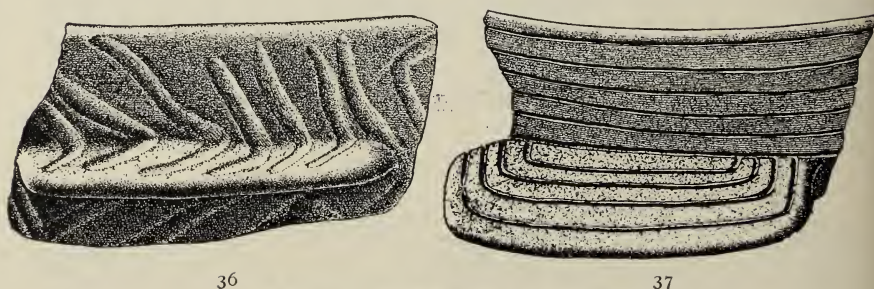
consists of a compound curve with shorter parallel curves occupying the semicircular spaces thereby produced.

Handles.—For convenience, the vessels were sometimes provided with handles, as above mentioned; often these were so rudimentary as to be mere knobs, but in some instances they were elaborated. These appurtenances may be designated as (a) loop handles, (b) ridge handles, and (c) simple knob handles.

The loop handles are sometimes plain, although the vessels to which they belonged may have been fully decorated with stamped

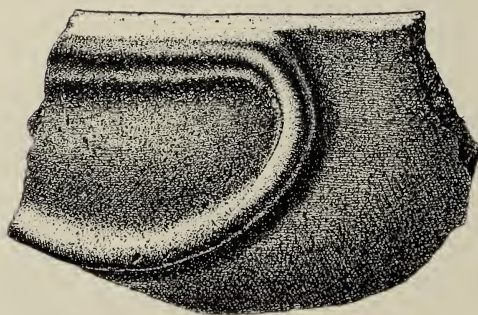


FIGS. 33-35.—Loop handles with incised ornamentation.



36

37



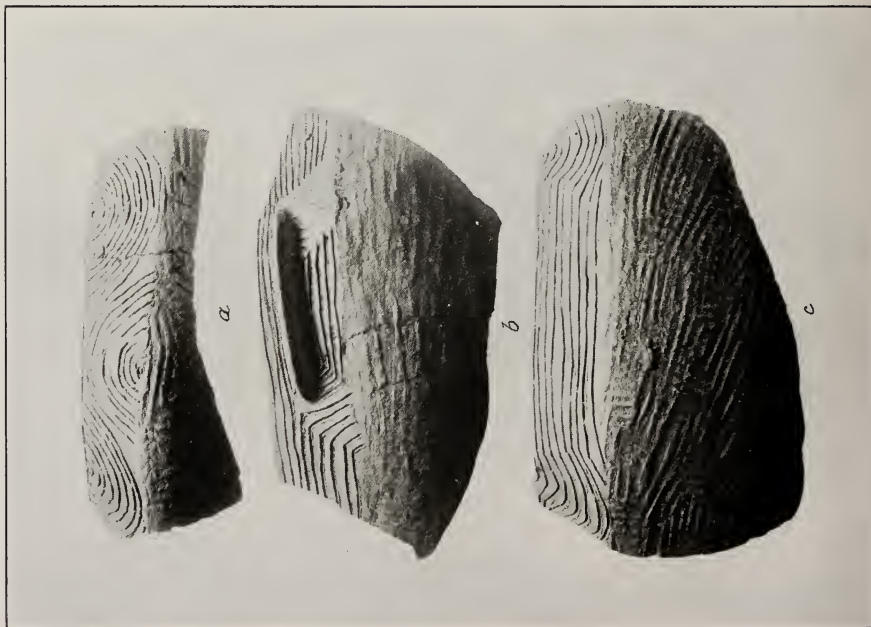
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FIGS. 36-38.—Sherds of vessels with ridge handles.

or incised patterns; in other cases the loops are themselves ornamented with straight or curved incised lines, or with small depres-

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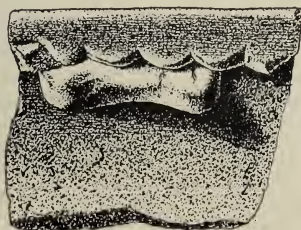
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sions, but in none of the specimens is the handle ornamented by stamping, for the obvious reason that the moist clay of the loop would not have withstood the pressure. Examples of loop handles are illustrated in pl. xxv, *a*, and in fig. 29-35. The method of



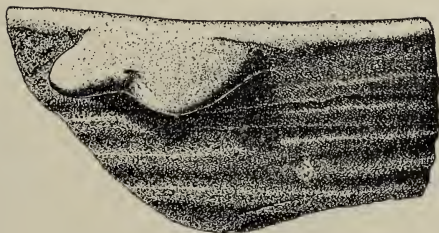
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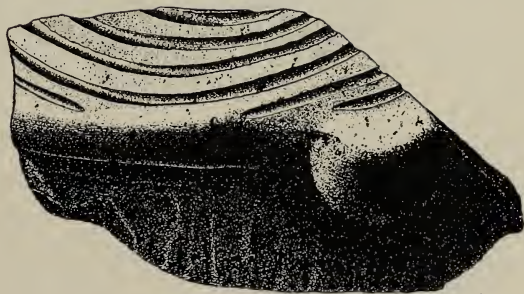
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fastening one type of loop handle to the wall of a vessel is shown in fig. 32.

Ridge handles consist of elongate projections beneath the rim. They are plain or ornamented, and sometimes are hardly distinguishable from the rim itself. Specimens are shown in pl. xxxviii, *b*, and in fig. 36-38.



41



42

FIGS. 39-42.—Sherds of vessels with knob handles.

Knob handles are more or less similar to the ridge handles, but are shorter. Examples are illustrated in pl. xvii, *b*; xxii, *d*, *f*, and fig. 39-42.

We have already mentioned certain small effigies in connection with the description of the rims of Nacoochee utensils and which

doubtless served the purpose of handles. The figurine resembling the head of a dog (fig. 44) was probably broken from a vessel,

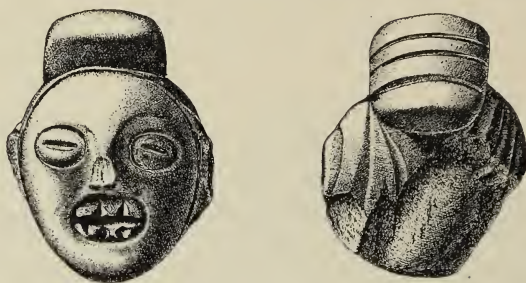
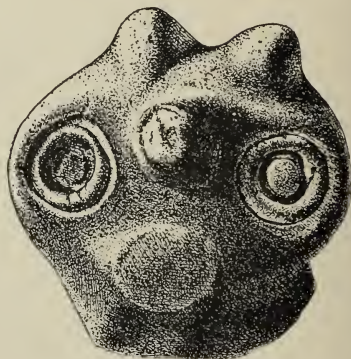


FIG. 43.—Grotesque human head of earthenware.

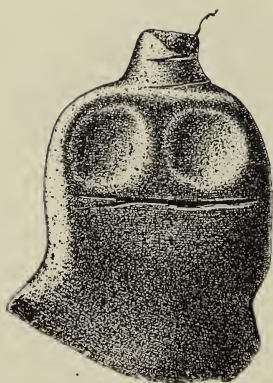
although what would have been the point of contact, if such were the case, is too much worn to make the determination of such use



44



45



46



47

FIGS. 44-47.—Animal heads of earthenware from the rims of utensils.

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EXAMPLES OF INCISED ORNAMENTATION

certain. The well-sculptured grotesque human head (fig. 43) was probably used either for a similar purpose or else adorned a pipe—more likely the latter, as the ware is well polished and of the superior quality characteristic of the manufacture of pipes rather than of domestic utensils. An interesting feature is the head-dress, represented as a triple-banded fillet above the crown. On the other hand, the relatively rude owl-like head (fig. 45) was probably broken from the rim or neck of a large cooking-pot, and the same is true of the grotesque sculpture of red-burned clay represented in fig. 46, which possibly represents the head of a soft-shell turtle.¹

ORNAMENTATION

Stamped Patterns.—Particular attention was given by the makers to the ornamentation of their pottery with stamped patterns or with incised designs, and in numerous instances both of these modes of embellishment were employed on the same vessel, in these cases (if we may safely make an imaginary restoration of some of the utensils) the etching being confined to the upper portion.

The stamped ornamentation of vessels, however, seems to have been preferred to the incised variety, probably because this method was more easily applied, for when once the stamp or roulette bearing the negative of the design or ornament was fashioned, its use by any potter usually required little more than mere mechanical application on her part.

As might be expected, most of the impressed ornamentation is in straight-line patterns; but there are also numerous examples of curved figures, and some sherds exhibit a combination of the straight and the curved. As a rule the attempt was evidently made to stamp the pattern into the plastic clay without overlapping, but often the impression was so carelessly made as to confuse the repeated design, and there are instances in which the paddle had been applied so promiscuously as to destroy the pattern almost completely.

Typical examples of straight-line patterns are illustrated in pl.

¹ Earthenware bowls with similar grotesque heads in place are illustrated by Thruston, *Antiquities of Tennessee*, pp. 140-154, Cincinnati, 1890.

xxv-xxx, which convey a more adequate idea of the character of this style of stamped ornamentation than a mere description.

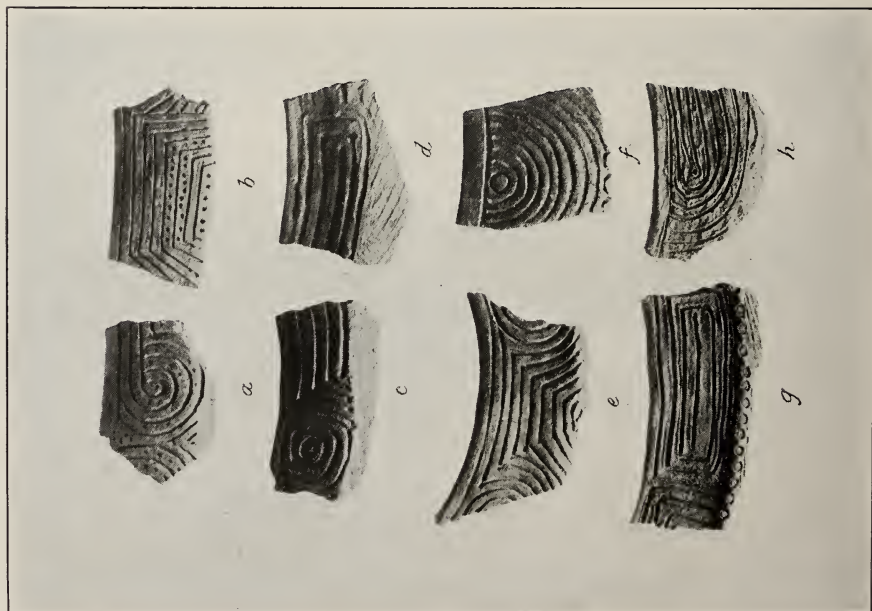
Some of the designs were stamped into the moist clay during the process of manufacture by means of earthenware paddles, as shown by portions of five of these illustrated in pl. xxxi. No entire paddles were found. Wooden implements also were used for this purpose; indeed on some vessels the grain of the wood shows quite distinctly between the relief lines of the ornamentation. The fragmentary pottery stamps referred to are incised on both sides, in one case (*d*, *d'*) the pattern being somewhat similar on the two faces, while in another (*c*, *c'*) practically the same design is seen on one side, while on the other an attempt has been made to produce a spiral-like figure, so frequently found on Nacoochee receptacles. No impressions from any of these particular pottery stamps have been found on any of the hundreds of sherds examined, but there are many that bear patterns of the same general types.

The section shown in pl. xxx illustrates part of a sherd of a very large jar which seems to have been ornamented by covering the face of the pottery stamp with a piece of thin cloth, which left its impression in the depressed parts of the design on the pottery. The portion of the pattern in relief was evidently smoothed with the hand in vessels with more deeply incised ornamentation, at least, and doubtless the same practice was followed in the case of the stamped decoration, as in pl. xxxvii, *d*, for example, for the purpose of removing any rough or sharp edges.

The stamped ware with curvilinear ornamentation is somewhat less common than that with straight-line or rectangular patterns, yet many hundreds of sherds of this variety were taken from the refuse. Most of the stamped ornamentation of this type was crudely applied, and, as in the case of the straight-line or angular decoration, care was not always exercised in avoiding overlapping of the pattern. Some of the impressions are very coarse, due both to the crudeness of the stamps and to the inexperienced manner in which they were applied. On the other hand, some of the fragments exhibit care and esthetic merit, the stamps having been carefully designed and prepared, and the stamping done with considerable

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SHERDS EXHIBITING INCISED ORNAMENTATION

skill. A selection showing the range of curvilinear patterns is presented in the accompanying illustrations (pl. XVII, *a, c*; XXXII-XXXV), which will afford a further idea of the artistic attainment of the Nacoochee potters.

A class of stamped ware that is likely to mislead one as to the manner in which the ornamentation was applied to the surface of vessels is characterized by horizontal, vertical, or oblique lines, sometimes crossed by other lines, produced by wrapping the paddle or roulette with cording made of vegetal fiber. Examples of these are shown in pl. XXXVI. In addition, there are specimens similarly stamped, but with a paddle on which was carved a series of small squares or rhombs and which had been so well manipulated as to give the appearance of basketry or of netting. Close study, however, of both these forms of surface treatment on sherds sufficiently large for observation, shows that they consist of repeated designs or patterns, in some cases more or less broken or overlapped. The fragments of the bottoms of jars shown on pl. XXXVII, *a, b*, are especially deceptive, both having the appearance of basket impressions, but which in fact were stamped as in the case of the other sherds referred to. The last sherd to which allusion is made, which is part of a vessel that had been considerably worn (pl. XXXVII, *c*), shows what appear to be the joints of the coiling process which the stamping had not wholly obliterated.

Incised Decoration.—The last type of pottery decoration to be considered is represented by the incised ware, or by a combination of incised and stamped. This method of ornamentation was applied chiefly to the upper part of bowls, forming a band below the rim; but a notable exception is the large jar to which allusion has already been made (pl. XVII, *b*), which is coarsely incised from the neck to the middle of the body with bold, broad, parallel angles, the lines forming the alternate groups of angles being long and short, and the apex of the outer angles of the alternate groups pointing respectively upward and downward. The scoring of the clay of this receptacle was done with a round-pointed instrument. In addition to two opposite rows of five nodes, each forming the decorative feature of the rim, there are, between these rows, two pairs of larger

nodes, also opposite each other, which evidently were designed to facilitate the lifting of the vessel, and therefore are a form of the knob handles already described. We may here mention that the clay of which this interesting jar was modeled was liberally tempered with shell, small flakes of which are visible inside and out.

The patterns employed in the incised work (pl. xvii, *b*; xix; xxxviii–xlII) consist of both straight and curved lines, scrolls, fret-like figures and concentric circles, worked out in varying combinations and in a few cases accentuated with punctate dots or with impressions made with the end of a cane-stalk. In some examples the lines, whether straight or curved, are extremely crude, having been etched with little control of the implement employed; in other specimens the workmanship is well executed and the result pleasing. It is not always possible to determine the kind of implement used in making the incised ornamentation, but some of the designs no doubt were produced by means of a graver of cane, the lines of which are quite apparent. In other examples it seems equally evident that anything handy might have been employed for scratching the lines, like a stick or a twig, and while sometimes no attempt was made to smooth the rough edges, the scorings were

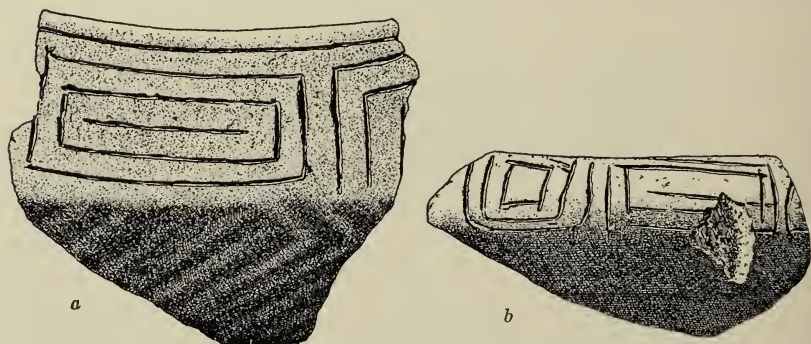
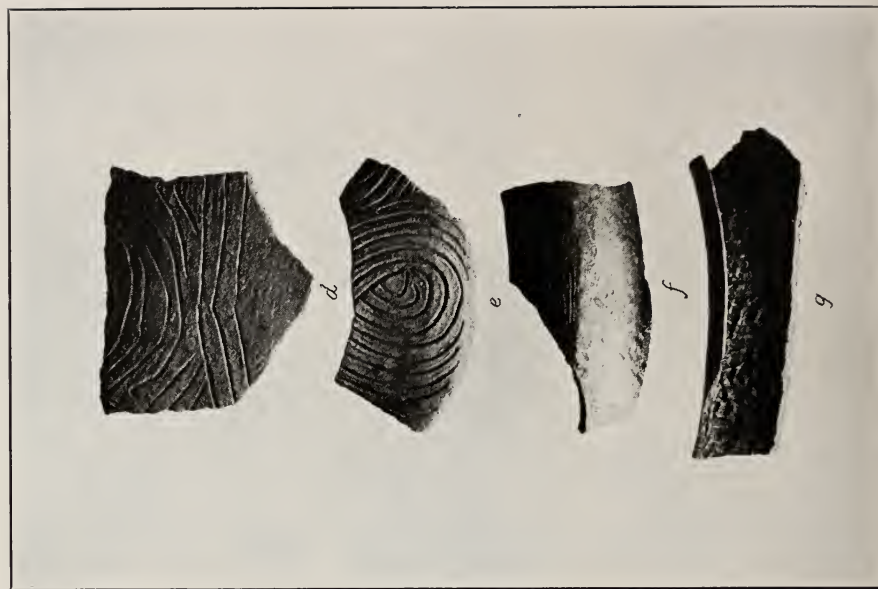


FIG. 48.—Sherds showing incised ornamentation.

often carefully routed, leaving the incisions clear and sharp. In two of the specimens illustrated (pl. xxxviii, *a*, and xxxix) the surface was pressed after the design was incised, as if to smooth away the roughened edges caused by the graving tool. In several sherds the etching, or more properly scratching, of the orna-

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SHERDS EXHIBITING INCISED OR IMPRESSED AND STAMPED ORNAMENTATION

mentation was effected with a sharp implement, in several examples illustrated (pl. XXXVIII, *d, i, j, k*, and fig. 48, *b*) the work having been done so crudely as scarcely to be worthy the effort of children.

While incised work was confined usually to the rims and the exterior portion of the necks of bowls, an exception is noted in a single sherd of a jar of reddish ware that had been scored rather deeply with parallel diagonal lines *within* the neck.

Regardless of the skill or the lack of skill exhibited by individual potters of Nacoochee, they manifested high regard for the ornamental, for only in exceptional instances did they fail to embellish their earthenware vessels with the best their esthetic sense inspired. Indeed they devoted as much attention in this respect to some of the coarsest ware as to the finest products of their ceramic art. In view of this fact it is strange that these people paid no attention to ornamentation of their pottery by painting, the painted effigy vase hitherto described doubtless being intrusive.

MISCELLANEOUS POTTERY OBJECTS

Certain pins or plugs of earthenware, two of them entire (fig. 49), the remainder represented only by stems and heads, are among the earthenware objects from Nacoochee. Such plugs are supposed to have been used to keep open the freshly-pierced lobes of the ears preparatory to the insertion of permanent ornaments of shell or other material. Such ornaments are mentioned and illustrated in connection with the description of shell artifacts (p. 93).

Beads of pottery are uncommon, only three having been found (fig. 50). The largest of these (*a*) is tubular, eleven-sixteenths of an inch long and painted red outside. Probably this was not designed originally as a bead, but was cut from the broken stem of a pipe. The

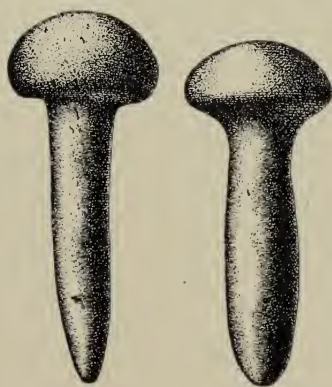


FIG. 49.—Ear-plugs of earthenware.

other two, however, were originally made as beads. One (*b*) is almost spherical, with a greater diameter of half an inch, and is of the reddish color of the burned clay; the other (*c*) is elongate, five-eighths of an inch in length, and flattish; both are crudely made, no attention having been given them beyond rolling or patting with the fingers.



FIG. 50.—Beads of earthenware.

A biscuit-like object of pottery, $1\frac{3}{4}$ in. in diameter and averaging three-quarters of an inch in thickness, rudely modeled and blackened by firing (pl. XXII, *e*), may have served the same purpose as some of the discoidal stones to be described.

Discs chipped or rubbed from potsherds were very common throughout the mound, having been so easily made that evidently little care was taken to preserve them. In diameter they range from about three-quarters of an inch to $3\frac{1}{4}$ in. and are of varying thickness. Sherds of any kind were used, little effort having been made to select well-finished fragments or those bearing attractive patterns; indeed in most cases the discs are of crude ware, indicating that the sherds were picked up at random and that perhaps weight rather than quality or finish was the desideratum. As might be expected, there is a greater proportion of ornamented than of plain pieces. Pottery discs of this kind are generally supposed to have been used in gaming. Owing to the disparity in their sizes, it may be presumed that the smallest ones were employed as counters. A few examples are shown in plate XLIII. These objects grade into a class of rude stone discs to be described, and in all probability were used for the same purpose.

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DISCS FASHIONED FROM POTSHERDS

SMOKING PIPES

PIPES OF EARTHENWARE

Whatever the esthetic attainments of the Cherokee of Nacoochee as exemplified by their pottery, they probably reached the height of their artistic ability in the manufacture of smoking pipes of earthenware and of stone. Writing of Cherokee pipes nearly a century and a half ago, Adair said:

"They make beautiful stone pipes; and the Cherokee the best of any of the Indians: for their mountainous country contains many different sorts and colors of soils proper for such uses. They easily form them with their tomahawks, and afterward finish them in any desired form with their knives; the pipes being of a very soft quality till they are smoked with, and used to the fire, when they become quite hard. They are often a full span long, and the bowls are about half as large again as those of our English pipes. The fore part of each commonly runs out with a sharp peak, two or three fingers broad, and a quarter of an inch thick—on both sides of the bowl, lengthwise, they cut several pictures with a great deal of skill and labor, such as a buffalo and a panther on the opposite sides of the bowl; a rabbit and a fox; and, very often, a man and a woman *puris natur alibus*. Their sculpture cannot be much commended for its modesty. The savages work so slow, that one of their artists is two months at a pipe with his knife, before he finishes it. . . . The stems are commonly made of soft wood about two feet long, and an inch thick, cut into four squares, each scooped until they join very near the hollow of the stem. . . ." ¹

The crowning example of artistry in pipe manufacture by the Nacoochee people is a specimen not found by our expedition but was recovered by Captain Nichols, who in 1870 unearthed the copper celt and other objects near the western base of the mound, as hitherto described. The pipe later came into the possession of Captain Nichols' daughter, Mrs George F. Payne, of Atlanta, from whom it was acquired.

The accompanying fig. 51 presents two views of this object, which is light-brown, the color of the clay, smoke-blackened on one side in firing. The bowl is covered with pyramidal facets (a favorite device in pipe ornamentation), and on the rear or smoker's

¹ James Adair, *History of the American Indians*, p. 423, London, 1775.

side is surmounted by a grotesque bird figure with diminutive body, large beak, erect ears, and bulging eyes. The front of the bowl rim curves upward to a point, and the short stem is finished with a heavy serrated flange. The inside of the bowl shows the irregularly vertical marks of a finishing tool, and the stem opening,

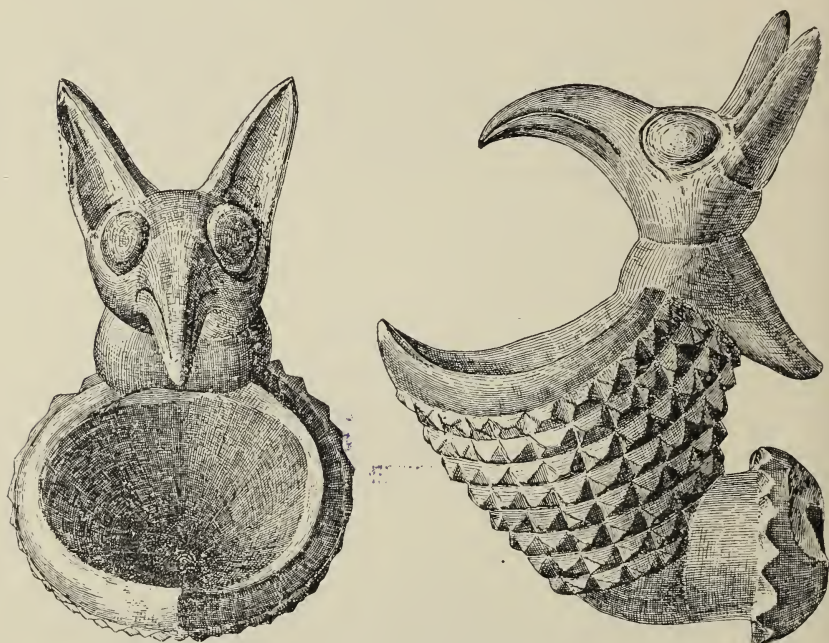


FIG. 51.—Earthenware effigy pipe.

which tapers moderately toward the bowl, exhibits faint horizontal markings as if scratched either with a tool or in twisting the stem in place. This fine pipe, which has been illustrated by McGuire¹ and by Holmes² from a cast in the National Museum, was probably found subsequent to 1873, the date of publication of C. C. Jones' "Antiquities of the Southern Indians," as it is not mentioned therein with other objects found by Captain Nichols at Nacoochee. McGuire's illustration is somewhat misleading in that it represents

¹ J. D. McGuire, *Pipes and Smoking Customs of the American Aborigines*, *National Museum Report for 1897*, fig. 237, p. 619, Washington, 1899.

² *Fifteenth Annual Report of the Bureau of American Ethnology*, pl. cxxv, Washington, 1903.

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EARTHENWARE SMOKING PIPES

the rim of the pipe-bowl as forming the legs of the bird, whereas they have no connection. The same writer states that the serrated stem band and the pyramidal ornaments on the bowl "all appear to have been cut out of the pottery subsequent to its baking." Whatever may be the appearance of the cast made years ago for the National Museum, the original pipe in the Museum of the American Indian, Heye Foundation, certainly affords no basis for any belief other than that the facets and serration were carved in the clay before the object was fired.

This effigy belongs to a favorite form of pipes from this region, the shape of the bowl resembling that of a lily, two plainer examples of which are illustrated in pl. XLIV, *b*, *d*. With the upward flare of the rim eliminated, we have another form (*a*, *e*, *g*), also common at Nacoochee, which in turn merges into other pipes similar in type but varying more or less as to proportion and ornamentation. The stems are invariably short, and almost without exception have a knobbed mouth-piece, although in a few specimens the knob had been broken off, the rough edges ground away, and the pipes no doubt made to do further service. The need of a thickened end to give strength to the pipe when the cane stem was forcibly inserted is apparent. The rather heavy pipe-bowl illustrated in fig. 52 was supplied with a cane stem only.

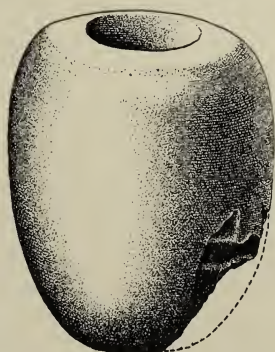


FIG. 52.—Earthenware smoking pipe.

The quality of the clay of which the pipes were made, as well as the tempering, is variable; some of the specimens are of excellent ware and were carefully and artistically modeled, but others are of the crudest description, especially two found with Burial 12, as if they had been designed to serve a temporary or funerary purpose. The finer ware seems to have had little or no tempering agent, and like the pottery utensils above described, paint was not employed as a decorative medium, if one may except three small pipe fragments on which traces of red paint, probably hematite, are seen.

One of these is part of the head of a bird whose mouth is colored red within.

The decorative features of some of the pipes are shown in illustrations to which attention has already been directed. Unfortunately many other examples are in fragmentary condition, but with knowledge of the form of some of the pipes it is not difficult to make an approximate reconstruction, in the mind's eye, of the complete features of some of the effigy and other figures with which the makers of the pipes embellished these cherished objects.

Most notable among the sculptures in clay is that of the bird on the pipe to which attention has already been given, and unfortunately this is the only complete specimen. Of sherds, however, we are able to present a few examples of bird forms, all but one of which are represented with serrate crests and all with prominent eyes. There is no doubt that these fragments (pl. XLVII) are parts of the rims of pipe bowls. A wolf-like head which, judging by the area of separation from the ware to which it had been attached, was probably part of a pipe, at any rate the curvature of what had been the point of contact is such that the head must have been fastened to a very small body. This head (shown in the central figure of pl. XLVII) bears traces of red paint.

We have already called attention to the use of a field of pyramidal facets as a feature of pipe ornamentation. Of this device several examples were preserved, varying in no particular from the ornamentation found on the body of the fine pipe first described, but applied also in the form of decorative bands or borders and merging into either closely grouped or isolated nodes of conventional or irregular form (pl. XLVII-XLVIII). Punctate or pressed markings, perforations, incisions, and pits were employed likewise as a means of ornamenting the pipe bowls, the treatment in some specimens resembling that of the rims of certain domestic utensils. Only a few of the many applications of these processes can be illustrated.

Perhaps we may regard the loop that terminated the rim of various pipes to have been more useful than ornamental, since it served as a means of attaching the pipe to the person. A few forms of plain loops are presented in pl. XLVII. We have already observed

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EARTHENWARE SMOKING PIPES

that three of the bird heads which formed the terminal projections of certain pipe rims bear apertures through the beaks, while another has the eye completely punctured, evidently likewise to afford a means of suspension.

TRADE PIPES

Various fragments of ordinary white clay trade pipes were found in the upper part and under the slopes of the mound. One of these bears a part of the manufacturer's mark on each side of the heel, the letters seeming to be an M and a W, but even these are not distinct.

STONE PIPES

While there are a few excellent stone pipes from Nacoochee, the specimens of this material as a whole do not compare favorably with those of earthenware. The catlinite pipe shown in pl. XLIX, *a*, found with Burial 2, lying 2 ft. 9 in. beneath the surface (see pl. XIV, *a*), is noteworthy both by reason of its form and finish and because it is the only specimen of pipestone found in the mound; indeed Jones (p. 407) states that he "failed to discover a single instance of the use, among the Georgia Indians, in ancient times, of the genuine red pipestone or catlinite." This pipe is $3\frac{3}{4}$ in. in length, fairly well polished, with the two sides faintly and crudely etched, and with a cross scratched in the base. The bowl is not smoke-stained, nor does it show any marks of tooling; the opening of the mouthpiece, however, retains the round markings caused probably by turning the stem in the socket. The serrated end of the body suggests the tail of a conventionalized bird. A hole has been drilled from both sides, midway of the body, evidently to afford means of suspension by a thong on which had been strung certain *Marginella* shell and glass beads, found in direct association, as before described (pp. 39-40).

Lieutenant Timberlake¹ speaks of a Cherokee calumet of catlinite in the eighteenth century as follows:

"During the dance, the peace-pipe was prepared; the bowl of it was of red stone, curiously cut with a knife, it being very soft, tho' extremely pretty when polished. Some of these are of black stone, and some of

¹ Memoirs, p. 39, London, 1765.

the same earth they made their pots with, but beautifully diversified. The stem is about three feet long, finely adorned with porcupine quills, dyed feathers, deers hair, and such-like gaudy trifles."

In point of finish the finest stone pipe from Nacoochee is of steatite and was found by Captain Nichols prior to 1873 in the field near the western base of the mound. This pipe (pl. L, *b*) is delicately wrought, the walls of the bowl being only about a thirty-second of an inch in thickness. It is highly polished, having much the appearance of glazed pottery. As in the case of the earthenware pipes generally, this one also has a flange at the end of the mouth-piece. Following the outer curve, the bowl measures nearly $1\frac{1}{2}$ in. from the rim to the heel. This pipe, which was procured from Mrs George F. Payne, of Atlanta, is figured by Jones and also by McGuire,¹ but neither illustration gives an adequate impression of the excellence of its workmanship. There are two other dark steatite pipes in the collection (pl. L, *a*, *c*), of approximately the same form, but heavier and of less careful finish. One of these has a very narrow lip, and the sides of the mouthpiece are slightly squared. The flange seems to have been broken off, only the edge remaining to show that the fractured end had been rubbed down to fit the pipe for further use. Both of these pipes were found in the refuse of the mound.

Another excellent pipe, of greenish-gray steatite, is shown in pl. XLIX, *b*. It measures $4\frac{1}{4}$ in. from mouthpiece to heel, the total length being 5 inches. This pipe was found with Burial 4 (pl. xv, *a*).

Rather crude in manufacture, jar-shaped, with heavy walls, is the gray steatite pipe illustrated in pl. XLIX, *e*. Like the fine little pipe of similar material, this specimen also belonged to the Payne collection, but it is not positively known to have come from the Nacoochee mound, although another of the same general form, but of hard stone, was found by us at the site.

Still another steatite pipe, with somewhat flaring sides, out-curving rim, and rather heavy walls, resembles some of the pottery forms. Its stem is broken off.

¹ C. C. Jones, *Antiquities of the Southern Indians*, pp. 410-411, pl. xxiv, New York, 1873. J. D. McGuire, *Pipes and Smoking Customs*, op. cit., p. 455, fig. 79. Washington, 1899.

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EARTHENWARE SMOKING PIPES

The brownish pipe of the same material represented in pl. L, *e*, is rather interesting by reason of the unusual angle formed by the bowl and the stem.

Interesting on account of its form, which is that of the claw of a bear or other animal, is the schistose pipe shown in pl. XLIX, *d*. Its bowl is very small, and the entire finish, excepting that of the convex surface of the front, is rather rough.

Exceptionally crude is what is probably an unfinished pipe of porous ferruginous granitic stone, almost of the consistency of

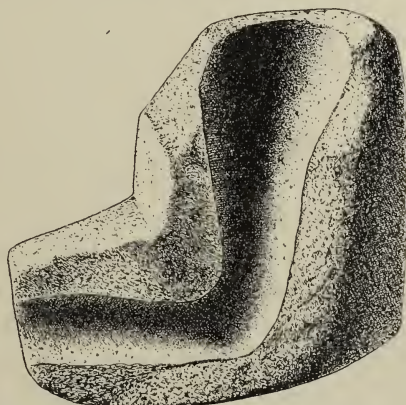


FIG. 53.—Part of a pipe of coarse sandstone.

coarse pottery, and stemless. The inside of the bowl and of the stem opening is smooth-finished, but the exterior is so rough as to suggest the primary stage of manufacture. Possibly the development of a crack extending halfway round the pipe was the reason for its rejection. It exhibits no smoke-blackening.

Part of another rude pipe (fig. 53) is of coarse red sandstone, broken almost through its center in such manner as to expose the entire interior. Smoke-blackening indicates that it had been used.

Possibly the cylindrical steatite object shown in pl. L, *d*, one and nine-sixteenths of an inch in length, and drilled or otherwise worked in one end to a depth of seven-sixteenths of an inch, may have been designed for use as a pipe bowl, although this is not certain.

The parts of two stems illustrated in *f*, *g*, of the same plate are

of interest as showing that stone pipes had been provided with means of suspension—an uncommon feature of Nacoochee stone pipes so far as our collections show.

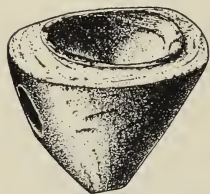


FIG. 54.—Part of a pipe bowl severed by cutting.

The basal end of a pipe of a compact brownish stone, cut from the rest of the bowl for some unknown reason, is shown in fig. 54.

OBJECTS OF STONE

Discoidal Stones.—Of all the objects of stone found at Nacoochee, the most numerous are certain discs or discoidal stones, fashioned usually from any water-worn or weathered stones, shaped by pecking or by rubbing, or by employing both of these processes. In most cases the rounding-out process by pecking or battering the edge was done rather roughly; in others the stone was further rounded either by modifying the natural pebble by slight rubbing on the prominent edges, or by rubbing the edges of the flattish stone that already had been more or less rounded by pecking or battering. Discoids of this type are of great variety of size and finish, their diameter ranging from a fraction of an inch to $4\frac{1}{2}$ in. They were found throughout the mound, usually in the refuse, but in a few cases associated with burials. Their function is not certain, nor is it known that the large and the small were used for a similar purpose; but from the crudeness of some of them, and their general resemblance in size and form to the pottery discs already described, it is not improbable that they likewise were employed in gaming. Indeed, from the softness of the stone of which most of these discoids are made, and the fact that they bear no sign of use as tools, it is likely that they were employed in games rather than for more practical purposes. A selection of these discoids is shown in pl. LI.

The discoidal stones of this class to which the natives gave most attention merge into another and less common form, made usually of a dioritic stone, carefully fashioned and polished. These vary similarly in size and form, some of them being of equal diameter on both faces, others having slightly or considerably beveled sides, and all having more or less rounded edges (pl. LII). A specimen of this type, of fine-grained granitic rock, was found with Burial I.

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PARTS OF EARTHENWARE PIPE RIMS SHOWING ORNAMENTATION

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PARTS OF EARTHENWARE PIPE RIMS SHOWING ORNAMENTATION

Still another class, closely approaching the last in form, but made of quartz, includes one specimen almost semiglobular in shape, while two others are identical in form with some of the dioritic discoids, but are of calcareous stone and seem to have been subjected to fire. Examples of this class are illustrated in pl. LIII.

It is difficult to reach any conclusion other than that the discoids flattened on one side and rounded on the other, if not those with both faces more or less flattened, were used in playing the chunky game, as described by Timberlake, who from personal observation among the Cherokee in 1761, wrote:

"The greater part resolved to amuse themselves at a game they call nettecawaw; which I can give no other description of, than that each player having a pole about ten feet long, with several marks or dimensions, one of them bowls a round stone, with one flat side, and the other convex, on which the players all dart their poles after it, and the nearest counts according to the vicinity of the bowl to the marks on his pole."¹

Some of the discoids of the class first described are of steatite, in no case so well finished as the adaptability of this material to the shaping processes would have made possible. A few of the steatite discoids are pitted, and in addition to the pitting two of the specimens have rudely incised lines radiating from the center, while one of them has also faint, shorter intervening lines (pl. LIV, *e*). This crude attempt at ornamentation was not confined to the steatite discoids, however, as a small one of porous ferruginous granitic stone, tufa-like in appearance, bears similar diametric markings (pl. LIV, *a*).

Other pitted stones are small (averaging $1\frac{1}{2}$ to $1\frac{3}{4}$ in.), clumsily made (pl. LIV, *d*, LV, *g*), and with a single exception are of sandstone or a granitic stone, the exceptional example being dioritic (pl. LII, *c*). In only one specimen of these objects is the pitting in one side only.

Of similar material and approximate size are perforated discoids (pl. LIV), some of them also grooved on the face, and one example having been perforated after breakage (*c*), care not being taken to

¹ Henry Timberlake, *Memoirs*, p. 77, London, 1765.

drill the hole centrally. The rude pendant-like specimen of this type (*i*) is of steatite, as also is the much better finished annular stone (*g*), on the faces of which ornamentation has been attempted by scratching.

Another class of pitted stones, evidently bearing no relation to those described, will be referred to later.

Abrading Stones.—The abrading or rubbing stones are not very numerous, nor do they offer any unusual types. They range from natural pebbles of soft sandstone, similar to some of the discoids (the edges worn by abrasion with other objects and the surfaces in a few cases being irregularly scored as if in pointing implements), to more or less irregular water-worn stones on which no workmanship had been expended in order to adapt them to the purpose for which they were designed. One fragment, judging by the stains on its only smooth face, was used for grinding hematite.

A rather interesting stone of this class, measuring 11 by 8 by $4\frac{1}{2}$ in., has a shallow groove, three-quarters of an inch wide, extending from one end of its smoothest face to the other, as if used in rounding or smoothing the edges of such objects as the smaller discoids above described, or for smoothing or pointing the ends of wooden objects.

Pottery Polishers.—Numerous small unworked pebbles, chiefly of quartz, were found throughout the mound, and two were associated with Burial 2, together with two diminutive stone discoids. These stones are of the class used for rubbing pottery before firing; they differ in no wise from the pottery-polishers so common at archeological sites wherever earthenware has been made, and which are still in almost daily use by our Pueblo Indians at the present time. What may have served, at least secondarily, as a pottery polisher, is a small spherical object of steatite (pl. LV, *i*), which will be mentioned later in referring to specimens made of that material. A small, dark, slate-like, triangular stone, an inch in length, thick at one edge but beveled at the other, may well have served the purpose of indenting some of the ornamental motives on the rims of certain pottery vessels.

Celts.—Considering the amount of exploratory work done at

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SMOKING PIPES OF STONE

Nacoochee, the stone celts¹ recovered (all but one of which had been deposited with the dead) are not numerous, and in this respect are not at all in keeping with the highly-finished discoids, for example, which the mound produced. But what the ten celts lack in number is met by the excellence of the workmanship (pl. LV, LVI). All are either of hard, compact stone, of the dioritic or granitic kind from which most of the highly finished discoids are fashioned, or of slate, and all but one (pl. LV, *e*) are perfect or nearly perfect in condition. Three are almost or quite flat and round or elliptical in section at the poll, and the poll of the small damaged celt was probably of like form; two are only slightly rounded, and likewise are elliptical in section; the poll in three is flattish and elongate, while that of another, battered shapeless by use of the celt as a hammer, was probably also of this form. The smallest celt measures 4 in. in length in its broken condition, $1\frac{3}{4}$ in. in width at the blade end, and 1 in. in maximum thickness; the next largest, flat, thin, and chisel-like (pl. LVI, *e*), and perforated near the poll, is $6\frac{3}{4}$ by $2\frac{3}{8}$ by $\frac{5}{8}$ in. in corresponding dimensions; the largest celt measures $8\frac{1}{4}$ by $3\frac{1}{4}$ by $1\frac{3}{4}$ in., while two others are only slightly smaller, if not so heavy. Four of the celts, including the perforated specimen as well as the largest one of the series, were found with Burial 53; others were associated with Burials 22, 56, 59, 60, and 63, while one, it may be recalled, was found apart from a burial. The perforated celt referred to possesses an interesting feature in that it shows a whitened band, nearly $1\frac{1}{2}$ in. wide and slightly diagonal, commencing just below the perforation, marking the former attachment of a handle; and another implement of this kind (pl. LVI, *f*) is similarly marked by slightly oblique lines of abrasion from the edges of the handle, as referred to in describing the copper celts.

Regarding the limited number of the celts, it should be borne in mind that, Nacoochee having been occupied far into the historical period, its inhabitants must have employed tools and implements of civilization long before the abandonment of the site, consequently tools of stone doubtless had been superseded by those of metal many years before. On the other hand, while fragments of celts

¹ See footnote, page 23.

and chisel-like implements were found, they were not sufficient in number to account for the fact that apparently at no time in the history of Nacoochee were many stone implements in use. It should also be noted that most of the celts were unearthed at considerable depth. A few fragments of small celts of fine-grained, granitic stone were found in the mound débris, but these afford no additional information. Not a single grooved axe was recovered; but an axe of this kind, found in one of the stone graves opened by Captain Nichols, is now in the Museum of the American Indian, Heye Foundation.

Among the chisel-like objects not described above are the well-finished and perforated specimen shown in plate LV, *d*, as well as a number more or less fragmentary, all small in size, and for the greater part thin and delicately finished. Among these fragments are represented three chisels, one edged at both ends, perfect except at the narrower end, measuring $3\frac{1}{2}$ in. long, 1 in. wide at the wider blade-end, and seven-sixteenths of an inch thick at the middle. The stone is very hard and compact, apparently granitic, and dark brown in color. The other broken implements of this type are not sufficiently complete to afford any interesting feature, save one of dark-greenish stone which has been used slightly for rubbing or polishing at the broken poll end.

A small chisel of hard, yellowish sandstone, complete, measuring $3\frac{11}{16}$ in. long and five-sixteenths of an inch in width as well as in maximum thickness, is of natural formation ground to an edge at one end (pl. LV, *f*). Another small chisel or celt, apparently of schist, 3 by $1\frac{3}{4}$ by $\frac{3}{8}$ in., showing slight sharpening at the broader end, is also of natural form; both ends are broken, the broader end so fractured as to carry away the edge opposite the sharpened edge mentioned.

Still another celt-like object (pl. LV, *c*), of dark-gray granitic stone, has a broken but formerly sharpened edge at the narrower end. The opposite edge has evidently been grooved on each side and then broken off. The longer edges of the implement have been beveled, probably through abrasion during use as a rubbing stone, thus suggesting its application to many uses.

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PIPES AND PARTS OF PIPES OF STEATITE

Steatite Objects.—Deposits of steatite are found in adjacent mountains, and although the inhabitants of Nacoochee made use of them, comparatively few objects of this adaptable material were found. We have already mentioned the rude annular and discoidal objects of soapstone, as well as the utilization of this material in the manufacture of pipes.

Two small fragments of large steatite vessels were found in the mound débris; likewise half of a diminutive vessel which, when complete, measured about $3\frac{1}{2}$ in. in diameter and $1\frac{5}{8}$ in. in height, and a portion of a crude annular object only slightly smaller in dimensions. More interesting is a coarse micaceous steatite object of unknown use, of the so-called "plummet" variety, 4 in. in length, $1\frac{1}{2}$ in. in maximum diameter at the middle, tapering to three-fourths and seven-eighths of an inch respectively at the ends, around one of which, half an inch below, a shallow and narrow groove has been cut as if to provide means of attachment (pl. LV, *b*). A similar object, $2\frac{1}{16}$ in. long and three-quarters of an inch thick, was in the Payne collection, and if it did not come from Nacoochee, it is certainly from that vicinity. Its flat base has a shallow depression and its top is knobbed. Another, more like the first one described, is illustrated by Jones and mentioned as possibly "employed to weight the hand-line in fishing with a hook."¹ Still another object, of indurated soapstone like one of the fragments of vessels above described, is roughly spherical in form, 1 to $1\frac{1}{2}$ in. in diameter, at one end of which a small boss or knob has been cut (pl. LV, *i*). From the fact that the under face of this object is smoothly worn, it may have been used in polishing pottery. It was found with Burial 2.

A steatite bead is mentioned on page 87, and reference has been made (p. 17) to the finding of a steatite ear-plug in a Nacoochee stone grave by Captain Nichols.

Considering the availability as well as the adaptability of the raw material, therefore, there was an unexpected paucity of steatite objects in the mound.

Pitted Stones.—Classed generally as pitted stones, or those which

¹ Jones, op. cit., p. 399, pl. XIX, 12.

bear depressions in one or both faces, there are numerous objects in addition to the pitted steatite discoids previously described. These range from fairly large, roughly-fashioned mortars (almost too shallow to justify the name, however), to pebbles or boulders sufficiently small to be held conveniently for pecking, pounding, and the like, the pitting having been designed to facilitate grasping. The materials range from hard, compact stone to soft sandstone.

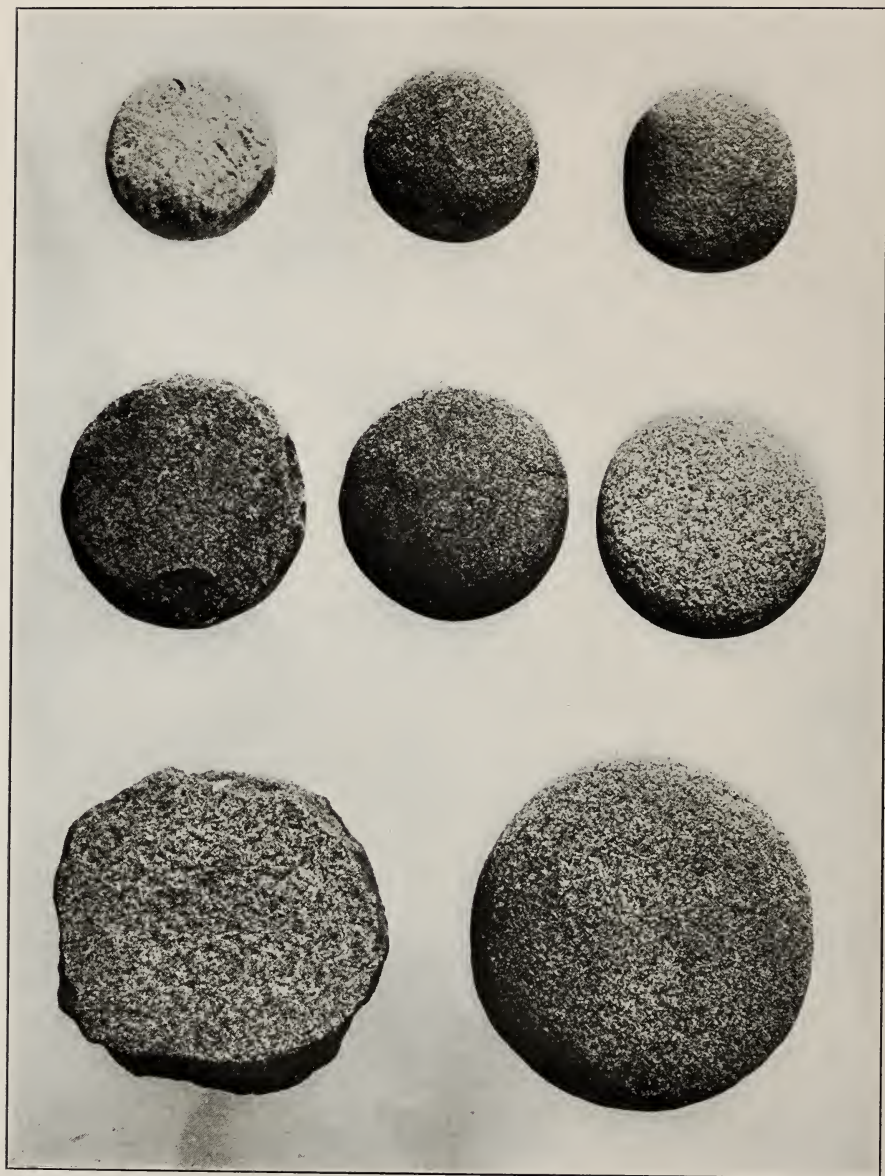
The large mortars, if we may so designate them, measure roughly 10 by 10 by 6 in. and 11 by 6 by $5\frac{1}{4}$ in. respectively in greatest dimensions, while the depression in each is only about 1 in. in depth and 5 in. in diameter. The stone of which each is made is very irregular, no shaping having been done in order to make it symmetrical; indeed it would seem that the first field stone at hand in each case was adapted to the purpose intended. An exceptional mortar, a mere toy in size (pl. LV, g), has a depression only large enough to receive the tip of the forefinger. This specimen recalls the tiny crude earthenware receptacles made by or for children.

Most of the pitted stones, and especially those with depressions in both sides, were used as hammers, as is shown by the convenient manner in which the pitting fits the thumb and forefinger, and by the presence of at least one battered end. A few examples of pitted stones, however, are of soft material, such as ferruginous sandstone, mica schist, etc., hence they could not well have served as hammers or pounders; and still other examples are pitted so slightly that their intended function is not apparent, although some of these come within the class sometimes, for want of a better name, are called "nut-crackers." A small discoid of greenish stone, measuring only seven-eighths of an inch in diameter by five-sixteenths of an inch in thickness, the edge slightly beveled, is pitted in one face (pl. LII, c).

Hammerstones not pitted were found in considerable number, and are of several forms, depending on the shape of the pebble or boulder, or on the use to which it was to be put. The simplest of these, of course, is the hard, more or less rounded, water-worn stone, not modified for the purpose of improving the shape, and battered usually at one end only. Others merge into the discoids,

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DISCOIDAL STONES PROBABLY USED IN GAMING

and indeed there are indications that some of the hammerstones were primarily designed for use as discs but were spoiled in the process of manufacture. There are no hammerstones of unusual form from Nacoochee, all partaking of the character of those common to archeological sites generally.

Net-sinkers.—Various flat stones, deeply or shallowly notched in one or both sides, and of the form usually called net-sinkers, were found in considerable numbers among the refuse (pl. LVII). These vary in size from 2 in. in width by $3\frac{1}{2}$ in. in length, to $3\frac{1}{2}$ and 5 in. for the same dimensions, and there were others, represented by fragments, even larger. Sometimes the notch is relatively deep and smooth, in other specimens there is little more than a suggestion of notching. Lack of indication of battering of the edges by use against other stones shows that these objects were not designed as stone-working tools, but served some such purpose as that of sinking fish-nets in streams. Indeed the stone of which they are usually made is too soft to have withstood hard usage, although a few specimens, of harder stone, may have been rejected hammerstones subsequently notched for use as sinkers. The largest specimen of this general type, $6\frac{1}{2}$ and 8 in. in medial diameters, is well battered at the narrower end, indicating its use as a hammerstone.

Ornaments.—Little in the way of stone ornaments was found at Nacoochee, even the burials being practically devoid of accompaniments of this kind, evidently because shell was more highly regarded for objects of personal adornment.

A crude object of laminated shale, shaped in the form of an arrowpoint by rubbing, but in no wise sharpened, may possibly have been used as an ornament, and a fragment of what appears to have been one of the wings of a bannerstone, or "butterfly gorget," found apart from burials, is the only object of this form unearthed.

Stone beads are entirely absent, excepting one of dark steatite thirteen-sixteenths of an inch in maximum length, tubular with slightly rounded ends, and neatly drilled from one end only (fig. 55). Jones (p. 235, pl. VI) mentions and illustrates a large stone bead as



FIG. 55.—
Steatite
bead.

among the accompaniments of one of the stone graves opened by Captain Nichols.

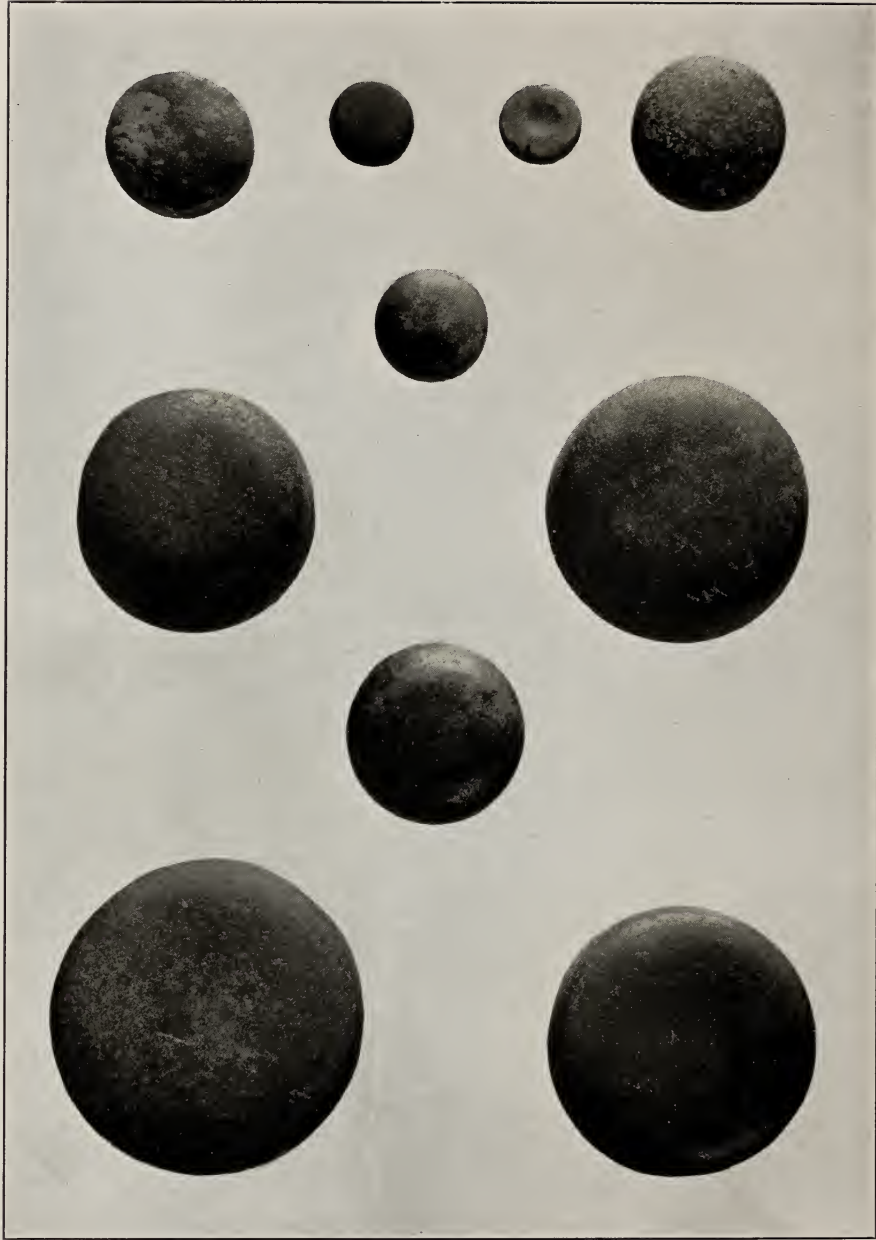
A tiny object, seemingly of ferruginous sandstone, only an inch by three-quarters of an inch in length and width (pl. LV, *h*), having much the appearance of a miniature grooved hammerstone, may have been used for ornamental purposes, or possibly as a toy.

Chipped Stone Implements.—Two lanceolate blades (pl. LV, *a*; LVI, *b*) were found in graves, the smaller with Burial 13, the other with Burial 14. The latter specimen, of grayish slate mottled with quartz-like nodules, is $8\frac{1}{4}$ in. in length by 2 in. in maximum width; it is nicely chipped, thin, with finely serrated edges, and perfect in condition. The smaller, of bluish gray flint or chert, is only half as long; it is likewise relatively thicker owing to the presence of refractory humps in the stone that evidently could not well be removed without risk of breaking the blade. One of the points is missing.

The remaining chipped stone objects found at Nacoochee—knives or spearpoints, arrowpoints, etc., offer nothing new in form or character. The best of the arrowpoints are of chert or flint; they are elongate as a rule, with rather prominent central ridges on one or both faces, and are without barbs, but often the base is made concave to receive the end of the shaft. A few examples are nicely chipped, symmetrical in form, and thin in section. In length, they range from three-quarters of an inch to an inch and five-eighths. A few of the arrows are of quartz, jasper, and chalcedony; of these the last mentioned are generally thinner and more skilfully chipped than those made of other stone. Most of the arrows were found apart from graves. With Burial 46, however, there were 45 of these projectiles, chiefly of flint or chert, and with Burial 59 there were three others.

The chipped stone objects of the knife variety, distinguished from the arrowpoints chiefly by their size, are of quartz in the main, and usually are clumsily made, some of them having irregularly chipped facets and prominent ridges. Sometimes the base is concave, as in the case of the arrowpoints, but, unlike the latter, some are notched for facility in mounting.

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HIGHLY FINISHED DISCOIDAL STONES

Altogether these implements, if we except the excellent lanceolate blades above mentioned, do not display great skill in stone-chipping on the part of the natives of Nacoochee.

A few gun-flints were unearthed in the upper part of the mound, within four feet of the surface.

OBJECTS OF SHELL

As already noted in describing Burials 39 and 74, it was the custom of the natives of Nacoochee, as well as of other Southern sites, to remove the columellæ of certain conchs for the purpose of transforming them into drinking-cups, and indeed Jones¹ has mentioned that "in the stone graves of Nacoochee valley more than one *Cassis flammea* was seen. In each instance the interior whorls and columellas had been carefully cut away, so that these large univalves formed capacious and serviceable vessels." Parts of similar cups, as well as columellæ of shells from which they had been fashioned, were found also in the refuse, and a columella was associated with Burial 14. But unfortunately shell objects of all kinds had become greatly disintegrated, evidently on account of the decaying effect of the moist soil of the mound. Numerous beads and other ornaments were of such limy consistency as to be beyond recovery, while others, although preserved, have lost much of their former shape. Exceptions to this condition are found in a Unio (*U. complatus* Dillwyn) and in certain univalves (*Polygyra albolabris* (Say) and *P. thyroides* (Say)), many hundreds of which, especially the former, taken from the refuse, are in excellent condition, the Unios retaining their nacre as freshly as ever. A small Unio has been drilled near the hinge to afford a means of suspension, evidently as a pendant, while two others have been serrated at one end, possibly for use in decorating pottery. Hundreds of these bivalves are considerably abraded at the longer outer edge by use as implements; indeed some are so greatly worn as to be concave, instead of convex as in nature, and as shells of this kind would have made excellent pottery-finishing tools, they may have been employed for such purpose. Others, while also worn at the outer

¹ Antiquities of the Southern Indians, pp. 233, 499, New York, 1873.

edge, retain their convexity, as would have been necessary if used for finishing the inner walls of earthenware vessels. It is possible also that some of these bivalves may have been used as spoons, although they are rather small for this purpose, and, moreover, the worn edge is squared rather than sharp, which would not be the case if employed for any purpose other than deliberate scraping, such as the walls of pottery receptacles. Moreover, very few of the shells exhibit the effect of wear on the outer surface.

The *Polygyra* shells bear no evidence of use, although many hundreds were found in the refuse, especially in that under the southeastern slope of the mound. Certain sherds of earthenware, however, bear a uniform crescentic decoration of the rim, such as might have been produced by pressing the lip of such a shell in the moist clay, as observed by Mrs Heye while assisting in the work of excavation.

It was for personal adornment that shells were chiefly employed, most of the worked specimens, especially various forms of shell beads, being found in association with the remains of the dead, as mentioned in the description of Burials 1, 2, 3, 5, 7, 13, 22, 33, 53, and 70.

Information respecting the use of shells by the Cherokee in the eighteenth century is afforded by Timberlake,¹ who says, "They that can afford it wear a collar of wampum, which are beads cut out of clam shells." Adair² gives further particulars regarding the use of beads and other shell ornaments by the Cherokee, as follows:

"The American *Archi-magus* wears a breast-plate, made of a white conch-shell, with two holes bored in the middle of it, through which he puts the ends of an otter-skin strap and fastens a buck-horn white button to the outside of each. . . .

"The Indian nations are agreed in the custom of thus adorning themselves with beads of various sizes and colours; sometimes wrought in garters, sashes and necklaces, and in strings around their wrists; and so from the crown of their heads sometimes to the cartilage of their nose. And they doat on them so much as to make them their current money in all payments to this day.

¹ Op. cit., p. 39.

² Op. cit., pp. 84, 170.

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HIGHLY POLISHED DISCOIDS OF QUARTZ AND CALCAREOUS STONE

"Before we supplied them with our European beads, they had great quantities of wampum; (the *Buccinum* of the ancients) made out of conch-shell, by rubbing them on hard stones, and so they formed them according to their liking. With these they bought and sold at a stated current rate, without the least variation for circumstances either of time or place; and now they will hear nothing patiently of loss or gain, or allow us to heighten the price of our goods, be our reasons ever so strong, or though the exigencies and changes of time may require it. Formerly, four deer-skins was the price of a large conch-shell bead, about the length and thickness of a man's forefinger; which they fixed to the crown of their head, as an high ornament—so greatly they valued them. Their beads bear a very near resemblance to ivory. . . ."

The shell beads worn by the inhabitants of Nacoochee are of several varieties, governed largely by the species of shells from which they were made. The largest ones were fashioned from the columellæ of conchs, more or less of the natural surface of the shell being preserved. The large beads men-

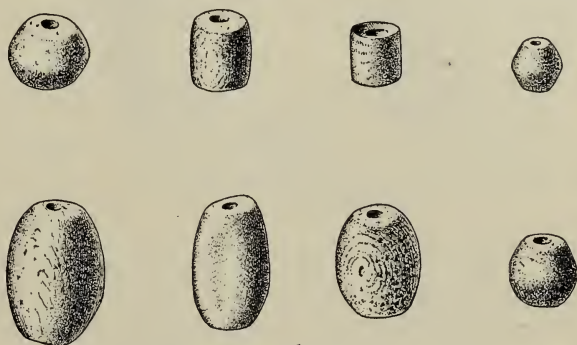


FIG. 56.—Various forms of shell beads.

tioned in the description of Burial 1 as forming a breastplate are of this kind, the ornament having been fastened in some manner by means of a string of smaller beads of two sizes, probably also made from columellæ, but all are so greatly disintegrated that the original form of most of them is not determinable. A number of these smaller beads, however, are similar to many found with Burial 3 in association with trade beads of blue glass, the whole likewise forming a breast ornament. Most of these latter shell beads are barrel-shaped, varying in size (the largest being half an inch long) as well as in thickness (the largest measuring seven-sixteenths of an



inch), while some of the smallest ones are cylindrical, others almost spherical, and only three-sixteenths of an inch in length. The largest beads made from conchs were found with a celt in association with Burial 53, one of which is $2\frac{1}{8}$ in. long by an inch in diameter, and all bearing very little finish, as if it were the desire of the maker to preserve as much of the shell as possible. Those found

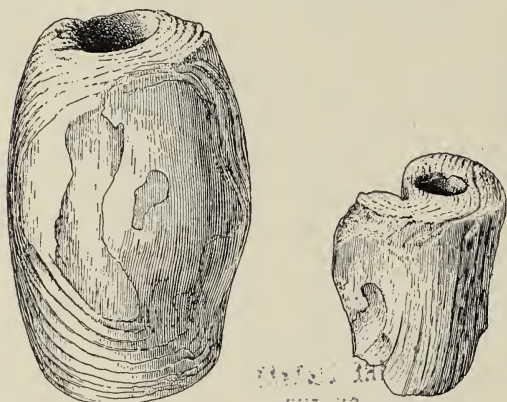


FIG. 57.—Beads made from the columella of the conch.

with Burial 5, however, had been more or less symmetrically shaped. Examples of shell beads are shown in fig. 56-57.

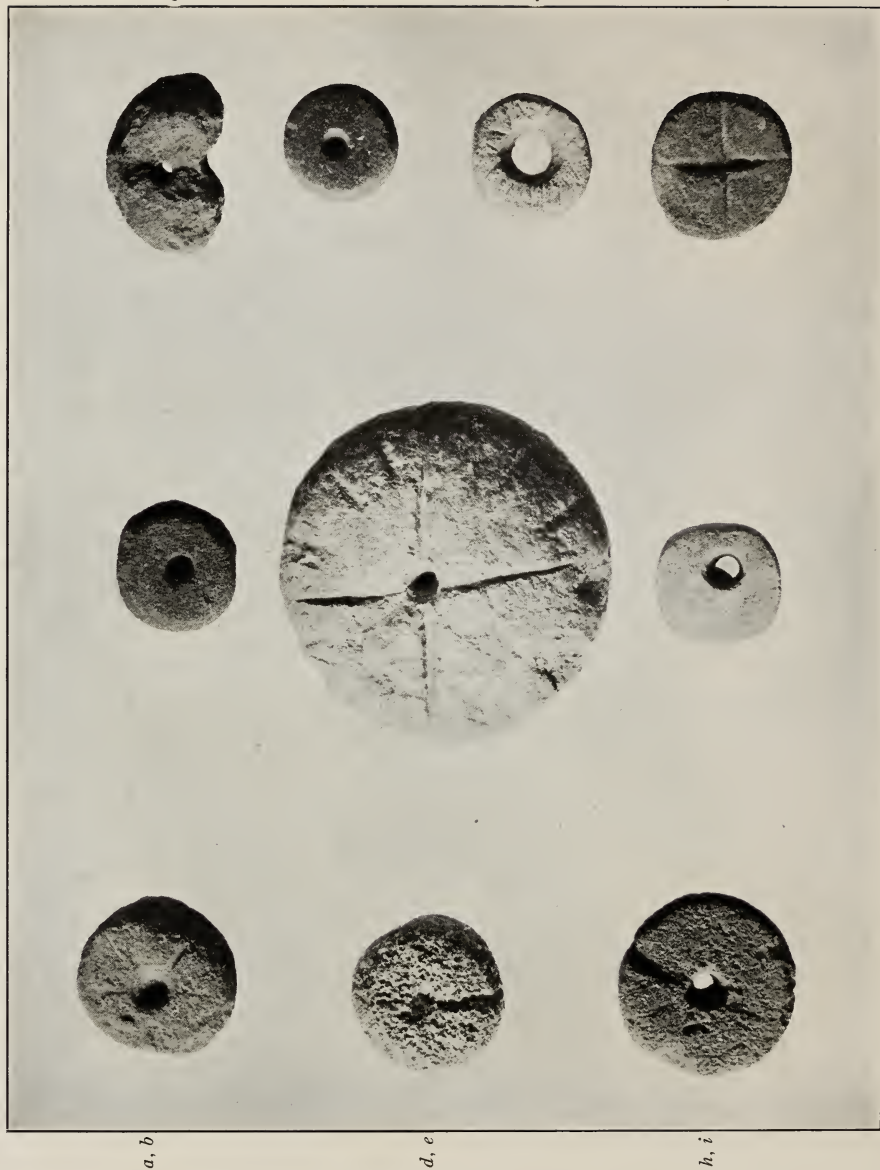
With Burial 2 were numerous *Marginella* shells (*M. conoidalis* Kien), found on and under the scapulæ and pelvis, evidently having been fastened to the shirt and leggings by sewing through an aperture

made in the wall of the shell by grinding or rubbing rather than by drilling. As in the case of Burials 3 and 4, these were accompanied with objects of European manufacture, including glass beads; indeed most of the shell beads were found in the upper part of the mound, within about four feet of the summit, which may not be significant if we account for the loss of others, deposited with the dead at greater depths, through complete decay.

Some of the shell beads found with skeletons are tiny and well made, a few of them indeed being so diminutive as barely to accommodate the drilling, being little more than a sixteenth of an inch in diameter.

In addition to the beads fashioned from conchs, large pendants or gorgets were made, as mentioned by Adair, but as in the case of most shell objects, these were usually decayed beyond recovery. One of these, perforated at the center, was found with Burial 13, beneath one of the fine chipped blades before described. It was

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DISCOIDS OF STEATITE AND OF OTHER STONE

in fragments, but when entire was probably five inches or more in maximum diameter. The object fashioned from conch shown in fig. 58 may have been intended for use as a pendant.

Finally, there were found with skeletons, in every case in connection with the skull, the remains of ear-plugs and hair ornaments evidently made from the conch. Enough of these objects remains to indicate that they were of two types—those with knobbed heads and those with flat heads, identical in form with some that have been found in Tennessee mounds. It will be recalled that Jones (pp. 233-234, pl. vi) de-

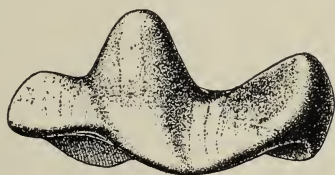


FIG. 58.—Object of shell probably designed for use as a pendant.

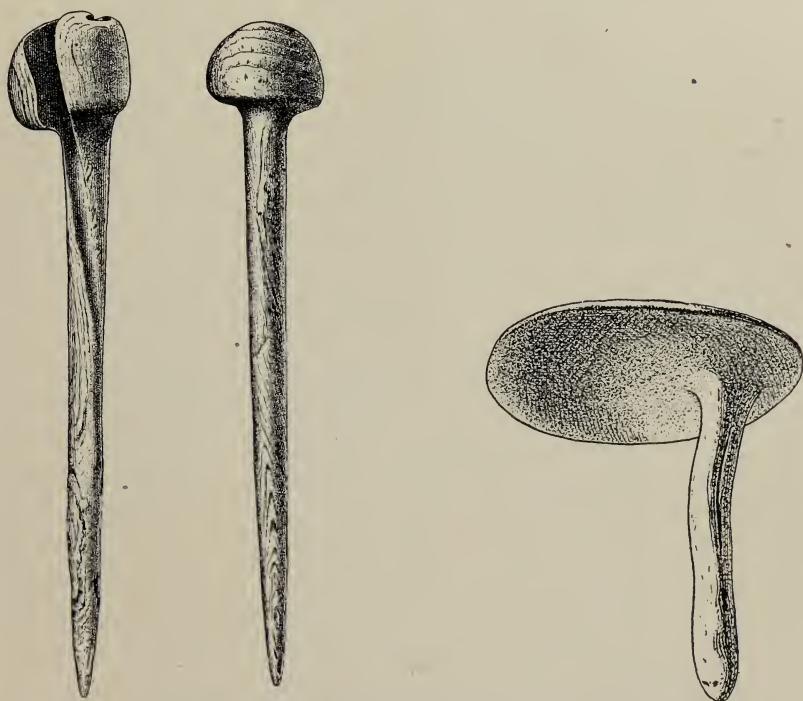


FIG. 59.—Ornaments of shell from the Soquee site.

scribes and illustrates two “shell pins” found in one of the Nacoochee stone graves by Captain Nichols, one of which was of the

knob-head form. We have already mentioned ear-plugs of pottery, probably designed for temporary use to enlarge the aperture in the freshly-pierced lobes, and Jones refers to and illustrates one of steatite of identical form, found also by Captain Nichols.

The disintegrated fragments of these shell ornaments found by us are practically worthless for illustration, but fortunately the Museum of the American Indian, Heye Foundation, possesses examples of all these forms of ear-plugs and hair ornaments from the Cherokee village-site of Soquee, only a few miles away. These are represented in fig. 59.

We have mentioned the use of ground shell for tempering the clay used in the manufacture of pottery receptacles.

OBJECTS OF BONE AND WOOD

There is a decided paucity of bone objects from Nacoochee, owing chiefly to the fact that implements and ornaments were not made of bone in considerable quantity, if conclusion may be based on the number of such objects found. Mammals and birds were no doubt abundant in the neighboring mountains in early times, and indeed bones in numbers representing the fauna of the region were found during the course of the excavation, including those of the Virginia deer, black bear (both of which were very numerous), gray fox, squirrel, opossum, and wild turkey.¹

Awls, as usual, are most prominent in the collection of bone objects. For the greater part, these were found with other refuse, having been cast away because of breakage. They are chiefly of deer bone, the articular process forming a convenient handle; but there are a few slender examples as well, all imperfect, made from animal ribs or from the bones of birds. None of them offers anything of particular interest, as all belong to well-known forms that have often been illustrated. A punch-like implement (fig. 60), $5\frac{1}{4}$ inches in length, is exceptional in the collection.

The most interesting specimen made of bone is the pin shown in fig. 61; it is $3\frac{7}{8}$ inches in entire length, the head being $1\frac{1}{8}$ inches

¹ The determinations were courteously made by Dr Gerrit S. Miller of the United States National Museum.

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VARIOUS STONE OBJECTS

in diameter from left to right. This object was found with the skull of Burial 70, exposed by the caving of the bank after a heavy rainfall.

Antler.—With the bones we may class the gouges and punches of antler, of which a considerable number, as well as prongs of



FIG. 69.—Bone punch.



FIG. 61.—Bone pin.

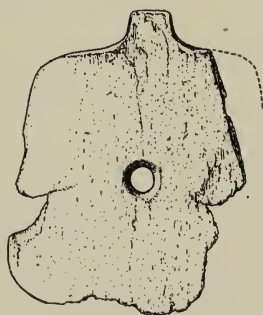


FIG. 62.—Ornament of tortoise-shell.

antlers that had no indication of artificial work, were encountered. The end of the largest prong is beveled to a chisel-like edge; the other examples were used as awls or punches with little if any modification.

Tortoise-shell.—Two imperfect ornaments made from the carapace of tortoises were found (fig. 62). Both are perforated at

the center, and had a pin-like projection at one end if not at both, but in each specimen it has been broken off.

Bear Tusks.—Mention has been made of the finding of numerous bones of the black bear in the refuse, indicating the abundance of that animal in former times and its use for food by the Nacoochee people. The presence likewise of hundreds of bear tusks suggests their use as implements for scratching and scoring wood, and probably also in pottery making. Indeed, as some of the tusks bear the marks of use both on the bony tissue and at the enameled end, there is little question that such an effectual tool should have been employed in various ways.

Wooden Ear-ornament.—The only preservable artifact of wood



FIG. 63.—Wooden ear-ornament.

found during the work is the small ear-button illustrated in fig. 63. This object, which was found with Burial 53, had evidently formed the core of an ornament that had been thinly plated with copper which has entirely disappear-

ed, leaving not even a stain on the wood to mark its former presence. The outer face is convex, the central part elevated, with an oblong aperture in the middle. The under side is chamfered at the edge and has a regular groove cut from opposite edges to the level of the chamfer. It is not certain that this core is complete.

OBJECTS OF COPPER

An account of the finding of the copper celt and sheet-copper ornament in the grave of Burial 46, and also of a similar celt and other copper objects in a grave unearthed by Captain Nichols near the western base of the mound, has already been given. It remains for us to mention two arm-bands of copper, each with a thin lining of bark, found on the skeleton of Burial 3 at a depth of 28 inches below the summit.

The first of these bands is $3\frac{1}{4}$ inches wide at one end and $2\frac{3}{4}$ inches at the other, and varies in thickness from a sixteenth of an

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CELTS AND CHIPPED KNIFE

inch in its heaviest part to that of thick paper where corroded through, for it was broken into pieces when found. The band does not taper gradually from one end to the other, the narrower end having been cut away at one corner to a depth of $1\frac{1}{8}$ inches from the termination. In this end two holes, and in the other one hole, have been punched, the roughened edges of the holes on the under side not having been removed.

The other arm-band is $3\frac{1}{8}$ inches wide at each end, but is slightly wider at the middle and is of the same general thickness. Three equidistant holes have been punched in one end and two holes in the other, but in the latter a corresponding third hole was commenced and the attempt abandoned.

Particles of bark still adhere to the under side of the arm-bands, the remains of a thin padding or lining for the protection of the skin of the wearer. There is no reason to suppose that these arm-bands are of commercial copper, any more than that the copper celts are of foreign origin.

MISCELLANEOUS MATERIALS

Scattered here and there in the mound or in the graves were fragments of mica, hematite, quartzite and other stones, galena, and such like mineral substances, largely the rejecta of manufacture or materials used for paint. Some of the hematite and galena show surfaces smoothed by rubbing for the purpose of reducing the raw material to paint, and deposits of hematite and ocher in pasty masses but which had once been powder, no doubt, were found in some of the graves, as likewise were a few quartz crystals, so precious to Indian medicine-men generally.

The plaited matting and fragments of woven fabric found with Burial 46 have already been described and illustrated (pl. VII, XVI, and fig. 2).

With Burial 39, as before mentioned, were found seven small drilled pearl beads that evidently had been worn at the neck.

OBJECTS OF FOREIGN ORIGIN

Beads.—No objects derived from the white man were found in the mound at a depth of more than four feet. Articles of foreign

provenience consist largely of glass beads, mostly spherical or barrel-shaped, blue or greenish blue, a number of them iridescent, a few striated with white. One of the blue beads is cylindrical, a little more than half an inch long, rounded at the ends, and much worn or weathered; another, also cylindrical, is half as long, with straight ends. There are also a couple of small plain white beads; two barrel-shaped ones, also white, each with three lines in red and blue, found with which, in Grave 4, were two smaller ones of the same shape but without the colored stripes; one purplish black in color with a netting of white wavy lines around the body; and one of amber-colored glass. The smallest of the blue-glass beads is less than an eighth of an inch in diameter, while the largest, somewhat barrel-shaped, is more than three-eighths of an inch long.

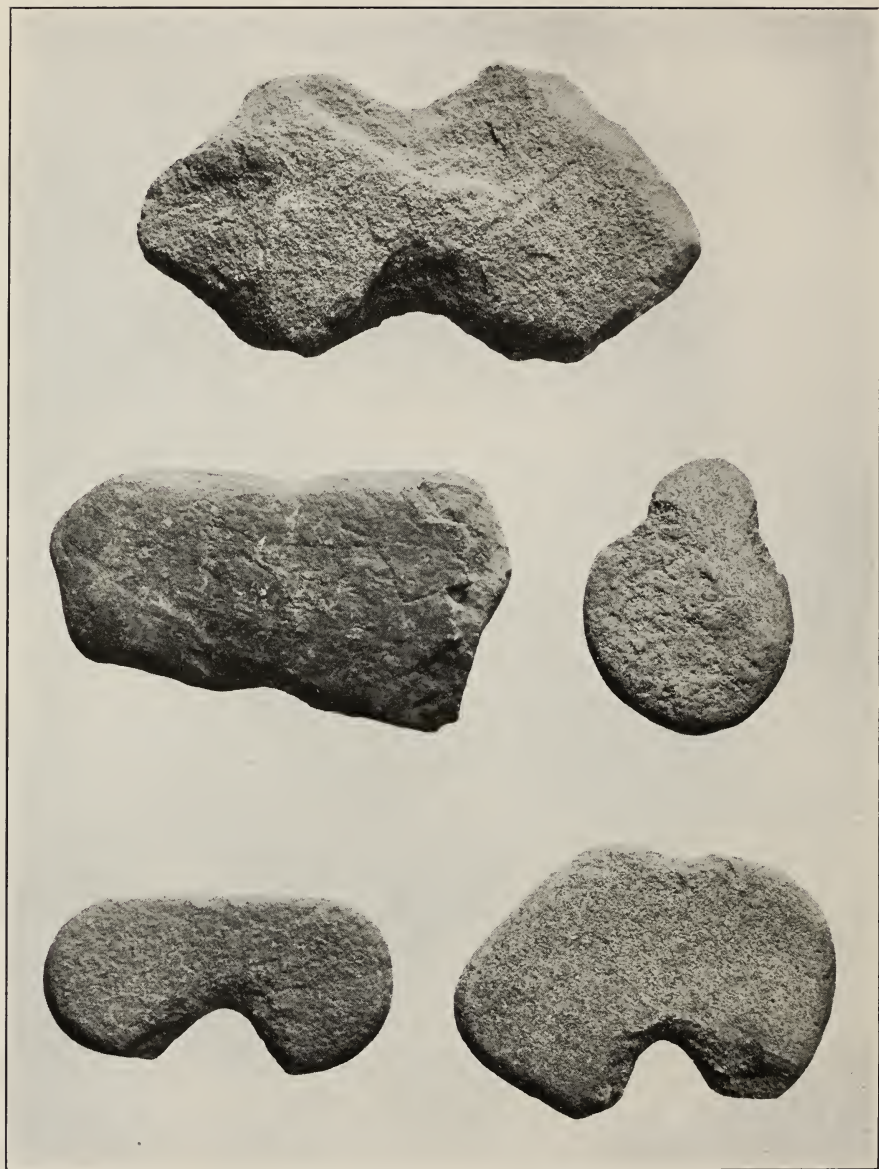
While most of these trade beads were found with comparatively recent burials, a few were recovered from the mound refuse. In two instances (Burials 3 and 4) trade beads in numbers were found with skeletons in association with native shell beads that had formed a breast ornament and a necklace respectively. It will be remembered that Captain Nichols plowed up in the adjacent field forty-five Venetian beads, "varying in shape and color, some of them being red, others blue, others white (of which variety some have a blue wreath, inlaid, encircling them), others green, with crimson and yellow horizontal stripes upon them, and others black."¹

Glass and Crockery.—Two fragments of bottle glass, one thin and green, the other thick and blue, were found not far beneath the surface, as likewise were some small pieces of crockery glazed on both surfaces.

Copper Objects.—With Burial 4 were a pair of well-made, circular, convex, copper buttons, $1\frac{1}{8}$ inch in diameter, with shanks, and with a small boss in the middle of the face. A fragment of tanned skin was attached to each button at the back, as if to form washers, or they may be parts of a skin garment to which the buttons were fastened, as they were found under the scapulæ and pelvis of the skeleton. In one of the shanks are remains of a

¹ Jones, op. cit., p. 235.

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NOTCHED STONES

fiber cord by which this button was attached, while with the other is a knot of dried skin, probably deerskin, evidently the remnant of a thong used in securing it.

A piece of sheet-copper, $2\frac{3}{4} \times \frac{5}{8}$ inches, is ground sharp at one end apparently for use as a chisel.

Another intrusive object of copper and one of iron, found near the surface, are of no special significance, as they give no indication of aboriginal modification.

Lead Objects.—Most important among the objects of lead are thirteen buttons, more or less disintegrated, three of which were in front of the arms, three near the feet, and others under a stone pipe at the base of the pelvis of Burial 4—the skeleton with which the copper buttons were found. The lead buttons, while now of irregular circumference, measure one inch to an inch and an eighth in diameter, and each bears on the under or concave side a central boss or stem which does not seem to have been a looped shank. Possibly this stem at one time was sufficiently long to pass through the garment and the button secured by bending.

Three crudely molded bullets of lead and also half of a bullet-mold of the same material were found in the upper refuse.

Mention has already been made of the finding of small fragments of clay trade pipes near the surface.

No more interesting intrusive object was found than the eight-real Spanish coin, dated 1808, which was taken from slightly under the surface at the northeastern base of the mound. A smooth round hole punched near the top indicates that the coin had been used as a pendant. It was not associated with a burial; hence may be regarded as having been lost during the occupancy of the site, and therefore in a measure as establishing a limit of time for its abandonment.

SUMMARY

The settlement of Nacoochee (Nagu'tsi'), with its artificial mound on which was the town-house, was inhabited by the Cherokee Indians from prehistoric times until about the year 1819, and is identified with the Guaxule of the chroniclers of the De Soto expedition in 1540. As prescribed by Cherokee custom, the village

was situated near a stream—the Chattahoochee river. Built of soil from the surrounding field, the mound at the time its excavation was commenced rose to an elevation of 17 feet, 3 inches; its summit, which had been dug away to a depth of two feet years ago, was 67 feet 4 inches in minimum and 82 feet 9 inches in maximum diameter, with a circumference of 231 feet, while the basal circumference was about 410 feet. The mound was primarily domiciliary, but numerous interments were made therein.

Desultory excavations were made near the western base of the mound in 1870 by Captain Nichols, the owner of the property at that time, resulting in the finding of three stone graves, with numerous accompanying artifacts, including a copper celt and other copper objects, as well as specimens of matting, shell, and steatite and other stone, including the only grooved stone axe known from Nacoochee. In the nearby field other artifacts were plowed up, including a remarkable earthenware effigy pipe, which, with most of the other specimens found by Nichols, are now in the Museum of the American Indian, Heye Foundation.

Various stone-box graves were found in the mound by the expedition of 1915, all in its lower levels; but there were also stone deposits, as if placed to mark the presence of burials, throughout the tumulus. By far the greater number of the interments, however, had been placed in earthen graves, and only twenty-seven of a total of seventy-five burials uncovered were accompanied with artifacts of any particular importance. Most of the dead were buried with their heads directed eastwardly. The skeletons were in a very poor state of preservation, none of them in condition for measurement. The remains of children were especially scanty, owing doubtless to complete decay.

The existence of fire-pits in various parts of the mound, on what had been its surface at the time of occupancy, as well as the stratigraphy of the mound deposits exposed by the trenches, which reached to a depth of more than 19 feet below the surface, showed beyond question that the mound had been built by gradual accretion and occupied during this process, which doubtless covered a long period of time. The finding of objects of European proven-

ience, especially glass beads, metal buttons, etc., in association with aboriginal artifacts deposited with the dead, all within four feet of the surface, indicates that the mound had been occupied and used for mortuary purposes after the coming of white people.

Although two feet of earth had been taken from the summit many years ago, this removal did not disturb an immense fire-pit, or series of fire-pits one above another, found immediately beneath the summit, near the center. The charcoal remains of poles and canes nearby suggest that this pit may have contained the sacred fire of the town-house, referred to in Cherokee tradition.

The pottery vessels were chiefly cooking-pots and water-jars, some very large, ornamented on the outer surface with stamped rectangular or curvilinear patterns, or incised over the neck and sometimes inside the rim. Ornamental rims, applied after the body was thus decorated, vary greatly in style, dentate and beaded borders predominating. The walls of the vessels are generally comparatively thin, and shell, sand, and mica were used for tempering the clay. The color of the earthenware is the natural hue of the clay, paint not being used as a decorative motive. A single intrusive effigy vessel, found in a stone-box grave near the bottom of the mound, is painted brown and white—the only example of painted ware found. Most of the earthenware was found in the form of sherds in the refuse on the former slopes of the mound, only one entire jar being in association with a burial. A few sherds of small vessels that had been covered with a red slip were found here and there, at no particular level, and some of the jars were of the natural reddish color of the burned clay. Some of the vessels had been provided with handles in the form of loops, knobs, or ridges. A few of the knob handles consist of effigy heads.

Pipes were abundant, although mostly broken, and are of both earthenware and stone, especially steatite. A pipe of catlinite was found with a burial not far beneath the summit. Some of the earthenware pipes bearing bird effigies as decorative motives represent the height of Nacoochee art. The finest of these, as well as the best example of a steatite pipe, was found in the early seventies and is now in the Museum of the American Indian, Heye Foundation.

Most numerous among the stone objects are the discoids, of varying forms and sizes, and made of various kinds of stone. They range in type from the very rude, to excellent symmetrical specimens with straight or beveled sides and rounded corners, made chiefly of dioritic and granitic stone, quartz, and marble. A few fine lanceolate chipped blades of chert, a number of large, well-finished celts of slate and a granitic rock, some of them still showing the marks of hafting, and a comparatively few objects of the everyday kind, complete the product of the more noteworthy stone implements from Nacoochee, which cannot be regarded as in any way rich in material of this kind. With one burial forty-five arrowpoints were found, some of them exhibiting good workmanship. Stone ornaments were almost entirely absent.

Shell no doubt had been used rather extensively at Nacoochee for ornaments, but the condition in which shell objects were found was such that in most cases they were far beyond preservation. Hair- and ear-ornaments were the most common. Drinking-cups made of conchs from which the columellæ had been removed, were probably in frequent use, as fragments were found from top to bottom of the mound. Musselshells were used as scrapers (probably in finishing pottery), and snail-shells were sometimes employed in ornamenting the rims of vessels. Beads, made chiefly from the conch, and with considerable range in size, were found with various skeletons, sometimes in combination with glass beads. There are also beads made from olivella and other small shells.

Objects of bone and wood are almost insignificant, the only exception being a few bone ornaments (probably hair-pins) and implements, and the wooden core of an ear-ornament that had probably been covered with sheet-copper and thereby preserved.

Most important among the copper objects, and the most interesting specimen in many respects found in the mound, is a celt, recovered from a grave near the bottom, associated with a small piece of fabric and a fragment of matting diagonally plaited. Part of the wooden handle of the celt is still in place, showing the method of hafting. In one of the uppermost burials were a pair of bark-lined arm-bands of sheet-copper, without ornamentation.

Nacoochee may be regarded as a typical Cherokee earthwork. While not rich in artifacts, the products of material culture are such as might have been expected to be revealed by the excavation of a Cherokee site occupied from prehistoric times through a considerable part of the historic period. The culture of its inhabitants had not been greatly modified by contact with civilization, for only the upper part of the mound revealed objects of European provenience. It is not likely that more than a few feet of the height of the mound were added during later historic times. Judging from Spanish descriptions of the sixteenth century the form of the mound became greatly changed after the advent of Europeans.

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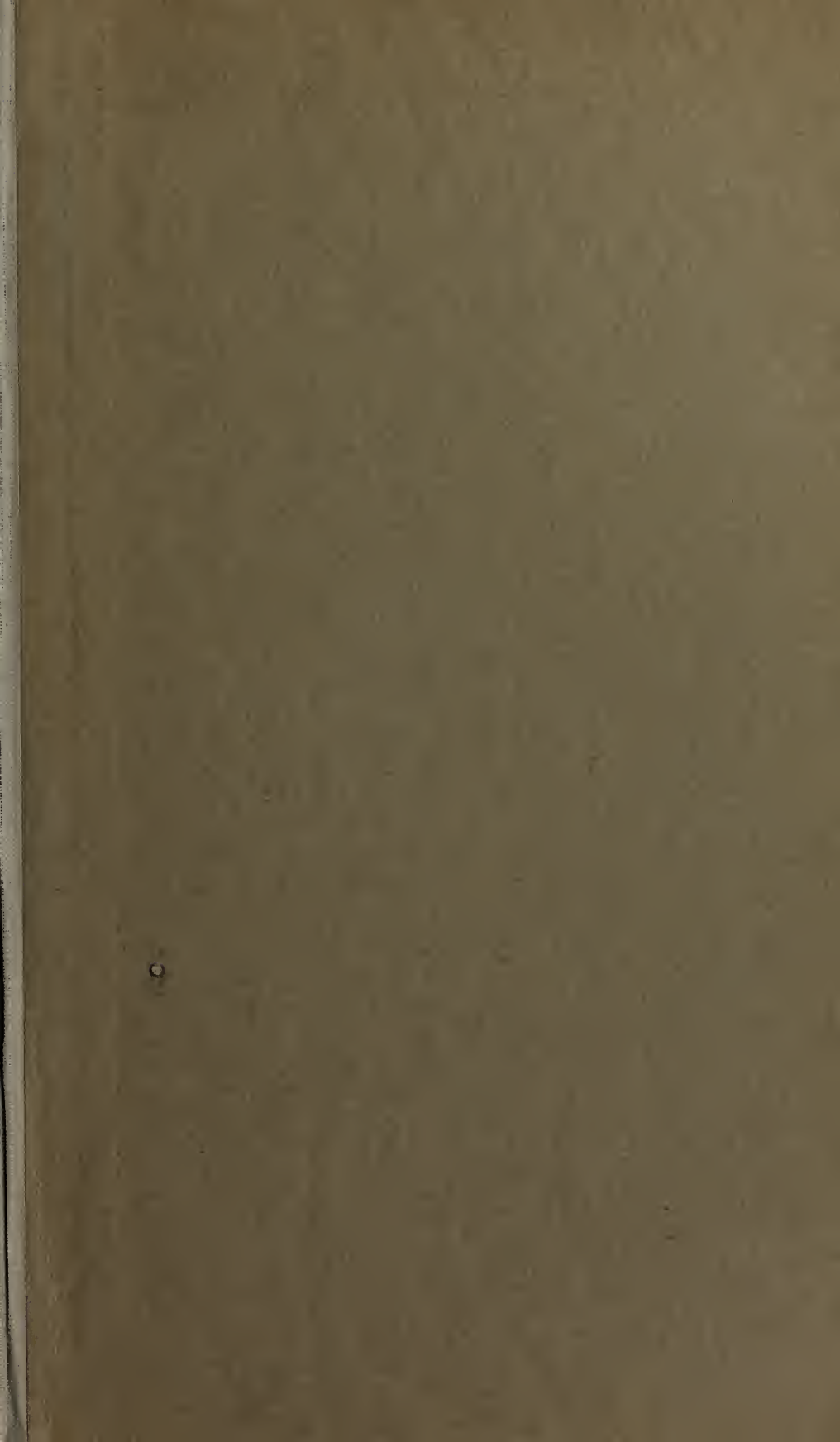
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